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Sketch of the Life and Work of Alexander L. Holley.

It is with feelings of the deepest pain and regret that we record the death of Alexander Lyman Holley, one of the greatest mechanical engineers that this country has ever produced. This sad and untimely event occurred at his home, 89 Joralemon street, Brooklyn, on Sunday evening, January 29, 1882, at 7:30 o'clock.

Born July 20, 1832, at Lakeville, Conn., where his father, ex-Governor A. H. Holley, still resides at the age of 77, the future engineer enjoyed educational advantages which were of great service to him in his subsequent career. While still a boy, his mechanical tastes induced him to spend some time at the machinist's trade. Graduating from Brown University, Providence, R. I., in 1853, at the age of twenty-one, he took the regular degree of the scientific course. His graduating address was upon the subject of "Motive Power," and displayed such promise, as to warrant the freely-made prophecy that that young man could be safely relied upon to make his mark in the world. He next entered the machine shops of Corliss & Nightingale, in Providence (now the Corliss Steam Engine Works), in the double capacity of workman and student, and left this establishment to become a working locomotive engineer on the Stonington and Providence Railroad, where he remained for about a year. To what good purpose he held this position, those of his friends know, who have had the fortune to hear him relate his experiences in running "The Old Jigger," as he humorously called his (Corliss built) locomotive.

Leaving this employment to be draughtsman in the "New York Locomotive Works" of Breese, Kneeland & Co., located at Jersey City, he became a contributor to various technical journals, and was at one time proprietor of the *Railway Advocate* (founded by Zerah Colburn, who afterward founded London *Engineering*), which publication ceased to exist during the hard times of 1857. While employed at Jersey City, he made the first colored and shaded drawing ever made in those works. It was of the locomotive "America," and was noticeably finer than the lithographs subsequently made from it, eliciting the warm admiration of every mechanic who saw it.

Going to Europe after this period, he contributed a series of noteworthy letters to the New York *Times*, in one of which he uttered a prediction, which then seemed ridiculous, but has since been strikingly fulfilled, regarding the coming supersedure of side-wheel steamships by screw propellers. About this time, in connection with Zerah Colburn, he published a book on American and foreign railway practice, which gave him conspicuous standing as a railway engineer. On one of his visits to England, he met Brunel and Scott Russell, the builders of the mammoth steamship, Great Eastern, and, making a voyage in that vessel, studied her construction and performances with the greatest care, with a view to thoroughly qualifying himself as a marine engineer.

Two or three years later, in the intervals of varied engineering work, he published another book relating to Railway Practice, which still further improved his standing in this important department of engineering.

About the beginning of the American civil war, the young engineer, who was still under thirty years of age, made the acquaintance of the Hoboken millionaire, Edwin Stevens, and became engaged as consulting engineer in the construction of the famous Stevens' Battery. This work led him to revisit England in 1862, for the purpose of studying the latest improvements in offensive and defensive marine warfare. While there, he devoted his attention, not only to the experiments with heavy ordnance and armor carried on by the British Government, but also, to the process of steel manufacture, then being introduced by Henry (now Sir Henry) Bessemer. This visit bore double and memorable fruit, resulting, not only in the publication in 1864 of his *Treatise on Ordnance and Armor*, which has since been accepted as standard on both sides of the ocean (having been translated into the French language), but also, in the introduction of the Bessemer steel manufacture into America.

ALEXANDER LYMAN HOLLEY.

Correctly appreciating the wonderful future that lay before Mr. Bessemer's invention, Mr. Holley, returning to the United States, induced John A. Griswold and John F. Winslow, of Troy, N. Y., to join him in endeavoring to obtain control of Bessemer's American patents. Returning to England in the summer of 1863, it was not until the spring of 1864, that he succeeded in making the desired purchase for the Troy firm of Winslow, Griswold & Holley. From this time on, the history of Bessemer steel manufacture in America, and to no small extent in Europe, has been, in a great degree, the history of Holley.

His first conspicuous mechanical success in the manufacture of steel occurred in the experimental plant at Troy on his thirty-third birthday, July 20, 1865, being the practical use for the first time of the cupola as a melting furnace for the Bessemer process. In these works, under his supervision, Bessemer steel manufacture also first became a commercial success in this country. It is mainly to Holley's improvements upon, and adaptations of the original Bessemer plant, that America is indebted for her present proud position at the head of Bessemer steel-producing countries.

Notwithstanding the timidity of capitalists and the fogyism of consumers, the success of the Troy works led to the establishment, in 1867, of the Pennsylvania Steel Works, near Harrisburg, Pa. Mr. Holley assumed personal charge, having previously furnished plans for the machinery. Relinquishing this position in 1868, he returned to Troy, where, in January, 1871, he substituted a 30-inch, three-high blooming train, located in the forge, for the methods previously employed, their production having been up to this time either hammered in the forge or bloomed from 9 inch ingots, as well as rolled into rails at outside establishments.

The mill was provided, front and back, with lifting tables, raised by hydraulic power. The rolls were turned to receive the 12-inch ingots, which were cast heavy enough to make two-rail blooms. These ingots, after being placed on the rollers of the front table, were pushed into the rolls, both front and back, by hand, the power of eight men being required to operate the mill. The train was built with the top and bottom rolls stationary; the middle roll was moved up and down by four screws running through the bolsters carrying the necks of this roll, these screws being rotated by a friction clutch, which was driven by a belt off the main shaft of the mill engine, and reversed by a hand lever at the end of the rolls. This mill, crude as it would now seem, proved to be a great advance upon the old practice.

Other works built by, or under the supervision of Mr. Holley, as consulting engineer, were those of the North Chicago Rolling Mill Company; the Joliet Iron and Steel Company, of Joliet, Ill.; the Bethlehem Iron Company, of Bethlehem, Pa.; the Edgar Thomson Steel Company, near Pittsburgh, Pa.; the Lackawanna Iron and Coal Company, of Scranton, Pa., and the Vulcan Iron Company, of St. Louis, Mo.

Among the improvements added by Mr. Holley to the existing Bessemer plant as enumerated by Mr. Robert W. Hunt in a paper read before the American Institute of Mining Engineers, were these:

"He did away with the English deep pit, and raised the vessels to get working space under them for the ground floor. He substituted top-supported hydraulic cranes for the more expensive counterweighted English ones, and put three ingot cranes around the pit, instead of two, thereby obtaining greater area of power. He changed the location of the vessels as related to the pit and melting house. He modified the ladle crane, and worked all the cranes and the vessel from a single point. He substituted cupolas for reverberating furnaces, and last, but by no means least, introduced the intermediate or accumulating ladle, which is placed on scales, and thus insures accuracy of operation by rendering possible the weighing of each charge of melted iron, before pouring it into the converter. These points cover the radical features of his innovations. After building such a plant, he began to meet the difficulties of manufacture, among the most serious of which was the short duration of the vessel bottoms, and the time required to cool off the vessels to a point at which it was possible for workmen to enter and make new bottoms. After many experiments the result was the Holley vessel bottom, which, either in its original form, or in a modification of it as now used in all American works, has rendered possible, as much as any other one thing, the present immense production."

Partly due also to his inventive skill, was the practice of tapping cinder from the cupolas, which resulted in a further large increase of production.

Soon after the erection of the Vulcan Works he turned his attention to the open hearth process for making steel. He made designs for open hearth plants for the Cambria Iron Company, the Springfield (Ills.) Iron Company, and the Spang Steel and Iron Company of Pittsburg. About two years ago he became consulting engineer for the Bessemer Steel Association of the United States, devoting his whole time to the interests of that Company. A considerable portion of his later work was in studying up and developing the capabilities of the Basic process, upon which he put his stamp as indelibly as he had previously done upon the Bessemer and the Siemens processes. He adapted the Basic process to Bessemer plant (as described by him in a paper read before the American Society of Mechanical Engi-

neers, and published in the AMERICAN MACHINIST of Nov. 20, 1880), and designed complete Basic plants which are yet to be erected.

During all the years in which he was accomplishing such results, Mr. Holley was a most indefatigable student as well as an incessant worker, thus burning the candle at both ends, as many of his friends have often reprovingly and tenderly said. The most generous and public spirited of men, he took an appreciative and active part in engineering discussion and fellowship. A prominent member of the American Society of Civil Engineers, and of the Iron and Steel Institute of Great Britain, he was also, in 1875, President of the American Institute of Mining Engineers.

He was appointed and served for some time as a member of the United States Government Board for testing the strength of metals. During the past two years he has also served as lecturer before the Columbia College School of Mines.

Few of our readers who read the address (published in our issue of March 13, 1880), which he delivered as presiding officer of the preliminary meeting, held February 16, 1880, in the office of the AMERICAN MACHINIST, for the purpose of organizing the American Society of Mechanical Engineers, will readily forget the admirable skill with which he outlined the scope of mechanical engineering, and the work which lay before the embryo organization. To the day of his death this strong, though infant, society, lay very near the heart of Alexander L. Holley, its first presiding officer, as it did to the heart of its second presiding officer, his intimate friend, the lamented Henry R. Worthington. As one of its most active organizers, Mr. Holley joined Professors Sweet and Thurston in issuing the invitations which have since brought three hundred representative mechanical engineers into a common bond of union for a high and serious purpose. With a few exceptions the rules of the new society, as they now stand, were drafted by Mr. Holley from his experience in the workings of similar organizations.

Mr. Holley was also a member of the Century and University Clubs of New York City. Though not avowedly a communicant of any church, he lived a blameless, helpful and religious life. While naturally anxious to round out his all too short life by more of the splendid work for which his mind was so well equipped, he more than once expressed himself as not afraid of death and ready to go.

In person he was moderately tall, somewhat spare, of a rather light complexion, sanguine temperament, and presented a fine appearance. Genial, witty, hopeful, and tender-hearted, he was one of the most self-sacrificing of men. It was a rule of his life never to speak ill of any one.

About a year ago he went to England upon professional business, but overwork and exposure in traveling prostrated him in London with a severe illness, from which he only narrowly recovered. Returning to America, he rallied and plunged again into the work which was at once so hard, and so easy, for him to perform, but returned to Europe last summer accompanied by his family. While there, he wrote from Interlaken, Switzerland, some very interesting "Traveling Notes," for the AMERICAN MACHINIST, which were published in our issue of September, 24, 1881.

Prostrated again in London about ten weeks ago by chills and fever, growing out of his former trouble, an affection of the liver, probably as a result of rapid tours among the iron and steel works of Europe, he was unable to join his family in a trip to Rome, to which they had long looked forward, through fear of the malarial effects of that poisonous climate upon his enfeebled frame, and succeeded in concealing his condition from them to avoid spoiling their holiday. His family rejoined him in London, only to find him in worse health than they had thought possible from his cheerful letters, and to see one of their number, his elder daughter, prostrated for many weeks with typhoid fever.

Positively ordered by his London physicians to quit that foggy climate, as the only hope of saving his own life, he again forced himself, for his family's sake, to appear better than he really was, and accompanied by his secretary, sailed for New York, leaving his sick daughter who had now begun to mend, in charge of her mother and sister. He reached New York after a rough voyage, about three weeks before his death. Keeping up his spirits and dictating cheerful telegrams to his absent family, until they had actually sailed for home, he then rapidly broke down, until near the end, peritonitis set in, and he died surrounded by devoted relatives and friends only ten minutes before the arrival of his wife and children. From the time he left them in London, he never saw wife or child again.

He leaves a wife and two daughters, both of his children grown to womanhood.

The funeral services were held in Plymouth church, Brooklyn, at twelve o'clock, Wednesday, February 1, followed by interment at Greenwood Cemetery,—numerous delegations from the three great engineering societies with which he was connected, joining his other friends in paying the last sad honors to all that was mortal of ALEXANDER LYMAN HOLLEY.

A Cheap and Convenient Shaft Coupling.

While looking through the shop of the Wright Machine Co., Worcester, Mass., a few days since, our attention was attracted by the shaft coupling shown in the accompanying cuts. It was designed by Mr. Edward Wright, has been used for several months with the most gratifying success, and by the courtesy of that gentleman is offered free (no patent) to all the readers of the AMERICAN MACHINIST who choose to adopt it.

The size taken for illustration consists of two iron castings 8″ long and 5″ diameter, held together over the ends of the shafts by four $\frac{5}{8}$″ bolts, $2\frac{5}{8}$″ long, also, a forged steel key, $6\frac{1}{2}$″ long, bent at right angles a half inch at each end. A recess for one side of the key is milled into one of the castings a quarter of an inch deep, and a corresponding recess milled into the ends of the shafts. The key is flat, except the bent portions at the ends which are round. The round ends are set in holes bored a suitable distance into the shaft. The key prevents the shafts, both from pulling apart and from slipping around in the coupling.

This style of coupling is very easily and quickly made, costs but little, has no projection to catch upon anything touching it when in motion, is very readily fastened in place, and just as readily taken apart whenever desired.

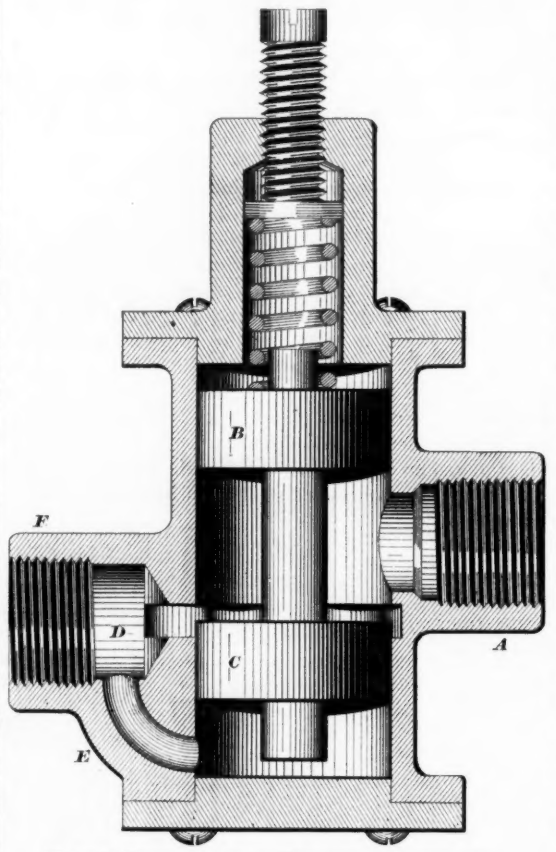
The size here mentioned will serve for $1\frac{1}{4}$″, 2″ and $2\frac{1}{4}$″ shafts.

Hand's Differential Pressure Regulator.

An efficient and reliable differential pressure regulator or "reducer," as it is sometimes called, is an important element in various manufacturing processes, as also in steam-heating apparatus, when, broadly speaking, low pressure steam is required, and a boiler carrying high-pressure steam is the only available source of supply. The regulator herewith shown is the invention of S. Ashton Hand, Toughkenamon, Pa., and the design is to furnish a device that—while it shall be effective and reliable in its operation, shall be of simple and cheap construction and not liable to derangement.

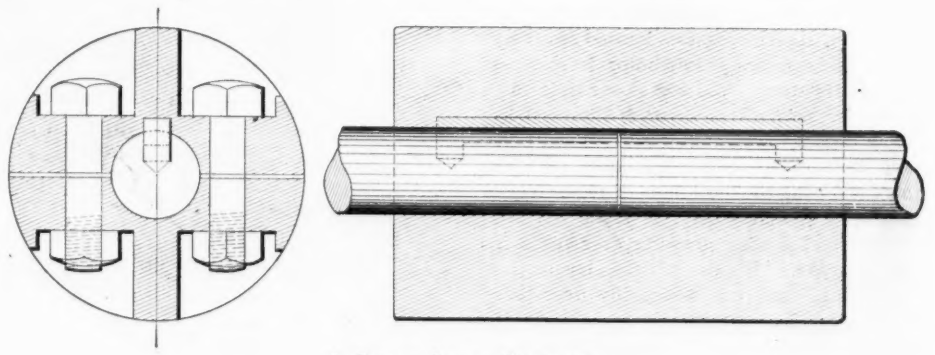
The regulator consists of a cylindrical chamber having two side nozzles, one of which, *A*, is connected with the supply pipe leading from the boiler, and the other, *F*, with the delivery pipe through which the steam, at reduced pressure, is led to the heater, vat, or other vessel in which it is to be used. Two pistons, *B* and *C*, of equal diameters, fitting the bore of the chamber, are secured upon a central rod therein, at such a distance apart as to allow the free opening of the supply and delivery nozzles to be uncovered between their adjacent faces. The pistons are pressed downward by a spring and adjusted conformably to the pressure required in the delivery pipe, which latter communicates through the back-pressure channel *E*, with the interior of the chamber below the lower piston.

An annular groove is formed around the inside of the chamber, communicating with the delivery opening *D*, to increase the discharge area and equalize the circumferential bearing of the steam on the lower piston *C*.



HAND'S DIFFERENTIAL PRESSURE REGULATOR.

In operation, steam from the boiler admitted between the pistons through the supply nozzle will pass (without tendency to vary the position of the pistons, owing to their equality of areas) into the delivery pipe, and acting through the back-pressure channel *E*, upwardly, upon the outer face of the lower piston *C*, will exert a pressure in the delivery pipe equal to the required delivery pressure, regulated by the adjustment of the screw and spring. Any increase or decrease of initial pressure in the supply pipe will correspondingly elevate or depress the pistons, so as to respectively decrease or increase the area of discharge opening through the delivery nozzle in a like ratio, and thus maintain the required degree of delivery pressure irrespective of variations of boiler pressure.


A CHEAP SHAFT COUPLING.

At the Phoenix Iron Company's Works, Phoenixville, Pa., a few weeks since, a key worked loose in the crank pin-end of the engine connecting rod. The engineer attempted to drive it back with a hammer while the engine was running. The key bounced out and the engine was instantly wrecked. The reserve engine was connected, and at the first revolution the cylinder head was knocked out, the water of condensation not having been allowed time to escape. This is the kind of profit employers sometimes experience by hiring incompetent engineers.

Experiments with Belts.

BY ROBERT GRIMSHAW.

Mr. Webber's belt tests published by you, May 21, 1881, go to show that pulley diameter has no influence upon the grip of a belt. We have made over 400 such tests and all our results point the other way. For instance, taking a 12″ 4-ply new rubber belt, on 36″ and 18″ new turned cast iron pulleys, with arcs of contact 90° and 180°, and gross weights on the light end, of 195 lbs. and 400 lbs. (or $16\frac{1}{4}$ and $33\frac{1}{3}$ lbs., respectively, per inch of belt width), we got the results shown in the first table.

It will be seen that (1) pulley diameter does in these cases influence the grip; (2) considering the arc of contact the same, the influence of pulley diameter upon grip decreases with the tension in one case, and is about the same in the other; (3) considering the tension the same, the influence of pulley diameter upon the grip decreases with the arc of contact.

The surface in nominal contact was the same with 90° on the 36″ pulley as with 180° on the 18″; but we find that with the light tension the grips in these two cases of equal surface contact were as 260 to 253; and with the heavy tension, as 405 to 544; the proportion being the other way.

Taking the first cases of 90° contact, 18″ pulley diameter, and 195 lbs. tension, we find that doubling the arc increased the grip to $\frac{265}{187}$=112 per cent.; doubling the pulley diameter increased it to $\frac{260}{187}$=190%; and about doubling the tension increased it to $\frac{268}{187}$=196 per cent. Taking the 180° arc, 18″ pulley, and 195 lbs. tension, doubling the pulley diameter increased the grip to $\frac{356}{253}$=140, and about doubling the tension increased the grip to $\frac{544}{253}$=215 %. With the 18″ pulley, 90° contact, 400 lbs. tension, doubling the arc gave $\frac{544}{268}$=215 per cent. as much grip; doubling the pulley diameter only, made the grip $\frac{405}{268}$=151 per cent. With the 36″ pulley, 195 lbs. tension, 90° arc, doubling only the tension raised the grip to $\frac{405}{260}$=156 per cent.; doubling only the arc gave $\frac{356}{260}$=137 per cent. of the grip. With the 36″ pulley, 90° arc, and 400 lbs. tension, doubling only the arc gave $\frac{805}{405}$=199 per cent. of the grip.

Arc.	Weight, light end	18″ Weight held.	36″ Weight held.	Per cent. Increase.
90°	195 lbs.	137 lbs.	260 lbs.	190
180	"	253 "	356 "	149
90	400 lbs.	268 "	405 "	151
180	"	544 "	805 "	148

There being some results in the above worthy of looking into, let us take another belt on the same pulleys and with the same arcs and tensions.

We will take an 8″ new 4-ply rubber belt. The tests gave the results shown in the second table.

Considering the 90°, 195 lbs. tension, on 18″ pulley, doubling the arc only gave an in-

Arc.	Weight light end.	Weight held. 18″ pulley	36″ pulley	Inc. Per cent.
90°	195 lbs.	132	260	197
180	"	237	596	253
90	400 lbs.	260	431½	166
180	"	432	621	144

crease to $\frac{3}{1}\frac{8}{8}\frac{7}{9}$=180 per cent. Doubling tension, only, gave $\frac{2}{1}\frac{6}{3}\frac{0}{2}$=197 per cent. Doubling pulley diameter, only, gave $\frac{3}{1}\frac{6}{3}\frac{0}{2}$=197 per cent. Taking the 18″ pulley, 195 lbs. tension and 180° contact, doubling tension gave $\frac{4}{2}\frac{3}{3}\frac{2}{7}$=182 per cent. grip; doubling pulley diameter gave $\frac{5}{2}\frac{9}{8}\frac{6}{7}$=253 per cent. grip.

Taking the 18″ pulley, 90° contact, 400 lbs. tension, doubling the pulley diameter gave 431½÷260=166 per cent. grip; doubling arc only gave $\frac{4}{2}\frac{3}{6}\frac{2}{0}$=166 per cent. grip.

With the 18″ pulley, 180° arc, 400 lbs. tension, doubling pulley diameter gave $\frac{6}{4}\frac{2}{8}\frac{1}{2}$=144 per cent. grip.

With 36″ pulley, 90° arc and 195 lbs. tension, doubling arc, only, gave $\frac{5}{2}\frac{9}{2}\frac{6}{0}$=230 per cent. grip; doubling tension only gave 431½÷260=166 per cent.

With 36″ pulley, 195 lbs. tension, and 180° arc, doubling tension gave $\frac{6}{5}\frac{2}{9}\frac{1}{6}$=104 per cent. grip; while with 36″ pulley, 90° arc, and 400 lbs. tension, doubling the arc gave 621÷431½=144 per cent. grip.

From this second set of tests, (in which, it should be observed, the tensions *per inch of belt width* are greater than with the 12″ belt), we may see that (with the narrower belt and consequent increased tension per inch of belt width), (1) pulley diameter does influence the grip in each case; (2) with the same arc, the influence of pulley diameter upon the grip decreases with the tension in each case; (3) with the same tension, the influence of pulley diameter upon the grip increases with the arc in one case and decreases in the other.

These results with the 8″ belt agree in the first and second items, with those obtained from the 12 inch belt, in which the case of bedding down was not so great, and the tension acting to bed it down, was less per inch of width. In the third item they differ. I think that I have a proper explanation of why they differ, and this I reserve until I can run over the whole 425 tests, and add to them some new ones with wooden pulleys, and so-called "raw-hide" belts.

Iron and Wooden Flasks.

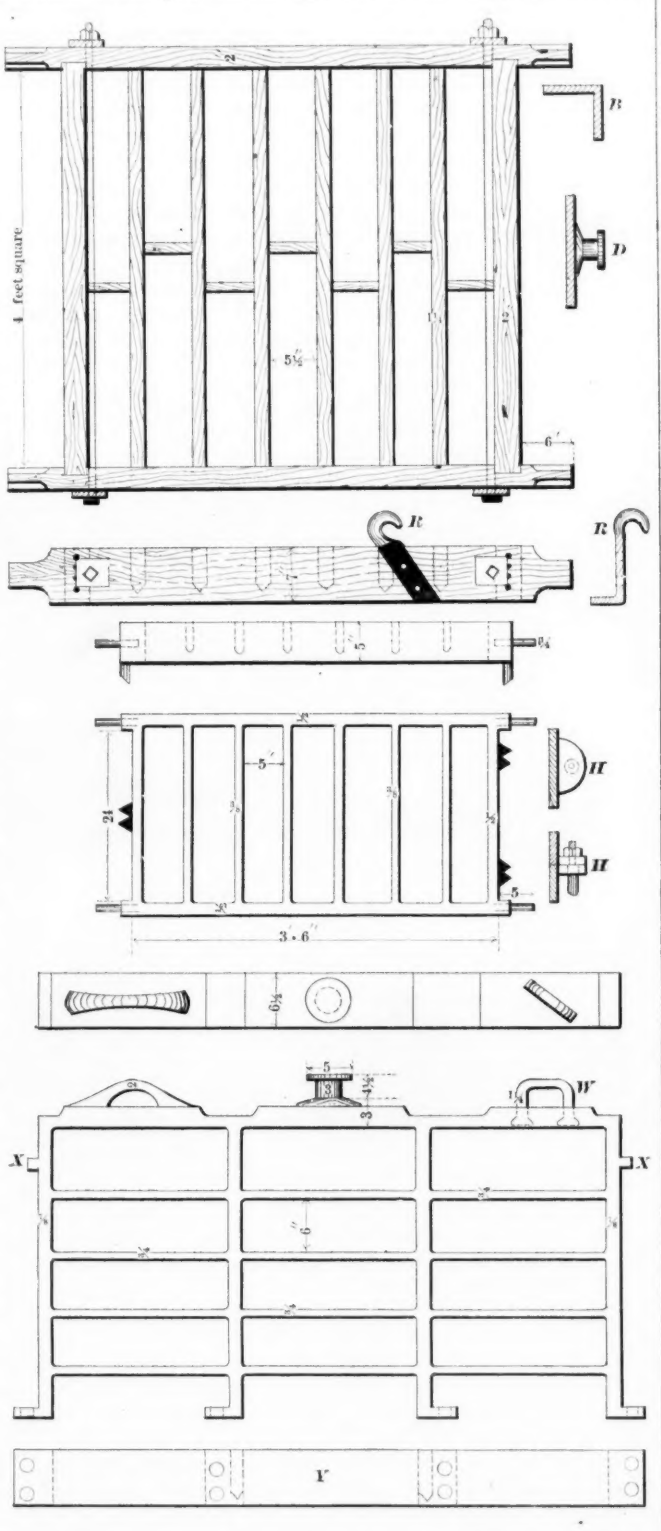
BY THOMAS D. WEST.

For a foundry to have a good supply of flasks is one thing, but to keep them in repair is quite another thing. In a jobbing shop especially, it is a serious trouble and expense to keep the flasks in order and mated. A moulder is at any time liable to get a job, to make, for which he will be obliged to take parts of several flasks—perhaps two or three copes and as many bottoms—and bolt or nail them together. Quite likely, to get what he wants, he gets in parts of a good many flasks to select from, and another moulder discovers that some of these pieces are just what he wants, and eventually, instead of being put where they belong, they are dumped down indiscriminately at the handiest place. Perhaps, to complicate matters, the foreman will order some of the parts of a half dozen flasks put carefully aside for furture prospective use, on another piece that *may* be ordered. In any event the parts of different flasks get promiscuously mixed, and the result is that some moulder looking for a cope to cover a pattern bedded in, or wanting a bottom to raise some part higher, will see these parts so nicely piled up, and the part that he wants at the bottom of the pile. Sooner than go for the man who has charge of the flasks to help him, he will throw down the whole pile, smashing pins and handles. This is the way the thing works in most every regular jobbing foundry.

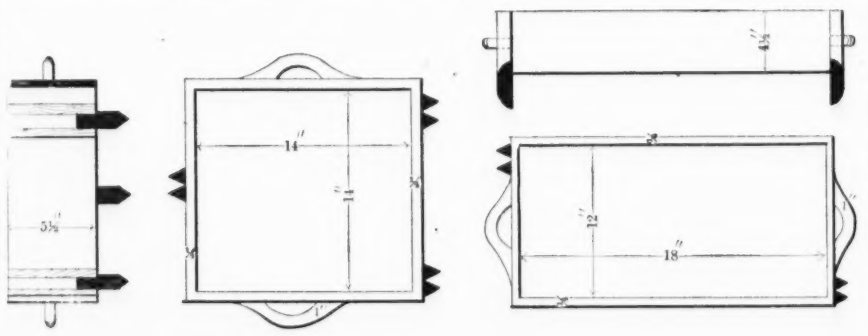
A foundry for special work does not require much over half the room that a jobbing foundry does, for storing flasks. In a foundry designed and equipped for special work there is generally a large number of flasks for the same pattern; and when any pattern is brought into the foundry to be made the foreman can send for the required flask, without spending two or three hours time in looking for stray copes and bottoms. Their flasks can be piled up high, because they do not have to be disturbed to get a part of a flask from the bottom of the pile. In such shops men will work months—sometimes years—with the same set of flasks, whereas, in some jobbing shops two weeks would be the limit.

In a jobbing shop, as a rule, the moulders, when going to work in the morning, have no idea what job they will start on, or the number of new jobs they may be called on to make before getting home again.

An assortment of miscellaneous jobbing flasks should have plenty of ground room, and the piles should be made open and not very high, so that a man looking for a flask will be able to see every part without having to throw down a pile. There should be some one in charge of the flasks, and he should report any man known to ill-use them, and then if the foreman does his duty there will be no need of moulders losing their night's sleep worrying over a drop-out caused by loose bars, crooked pins, or shaky flasks. Of course this does not mean that a jobbing shop cannot be run without having an acre or two to pile up flasks on. There are plenty of shops doing a large business that do not have much ground room, but have to hoist their flasks on the top of flat roofs; their very large ones are never taken out of the shop.



In this country wooden flasks are used more than in foreign countries. When foreign moulders come to work in America they wonder at so many wooden flasks being used. They are sometimes afraid to start to work with them, and if they have a run-out, or drop-out, the old wooden flasks get the blame.



Wooden and iron flasks each have their especial advantages: the iron one is the most durable, is stiffer, and can be relied on in matters of dropping, run-outs, or strained castings. Take a large plate full of holes, cast one with a wooden, and one with an iron flask, and then look at the difference in the two castings. The one made in the wooden flask, with all the time spent wedging down the bars, and blocking up to get the weights, or screw-down binders on, may be from ¼″ to ½″ thicker in the middle than it should be, and as for the holes they are not to be seen on the cope side at all. American moulders may smile at a foreigner using wooden flasks, but I remember a time when the smile was on the other side, and a loud one at that. As for instance, when an American moulder ran with a pail of water and threw it against an iron flask to keep it from burning up. The reader may laugh at this, but it is a fact nevertheless. Wooden flasks have also their advantages. They are handy to lift and carry, and better adapted for a dull foundry hatchet, to carve out the bars so as to admit of the cope being used for various castings. After being pitched around eight or nine times they will also save the cupola man lots of time and labor in hunting up kindling wood to start his fire with.

There are more iron flasks used in this country at present than were formerly used. Some shops that have a standard of work can rig up iron flasks with loose bars and side pieces, that can be bolted together to answer the purpose for making a variety of castings with one flask.

The sketches represent the principle of construction, &c., of plain iron flasks, such as every jobbing shop should or could use. The smallest ones without bars are very light and handy for small jobbing castings. The second size is a cope about as heavy as two men can lift off. The lug and pin, H, H., should be attached to special flasks where parts of the casting are to be made in the copes. This pin is expensive, as it involves considerable machine shop labor to make, as in turning the pins and boring the holes, but it will pay for itself in a short time, when used for making pulleys, etc.

For dry sand work that requires to be closed very true, the flasks should have three or four pins. The pins may sometimes need to be one foot in length so as to close true over cylinder port cores and the like. The pin shown, cast on the small flasks, costs very little to fit up and is very good for a plain class of work.

The large iron flask shown possesses several advantageous features. The round trunnion is a common but very handy thing for turning over copes so as to get to finish them easily. This may be cast on, the flask having handles, also, if required. The handle W, is of wrought iron, cast into the flask, which makes a neat lifting handle. It is cast in on a slant, so as to be in a line with the chains when lifting. The handle on the opposite side is cast iron and should be large for strength, but should be made convenient for hooking to. Guides, as shown, should be cast on for driving down stakes alongside of. The loose plate or bar Y can be bolted to the flanges, should the flask require to be made longer, or to have a piece or pocket bolted on for any purpose. To accomplish the same purpose, the whole flask is sometimes cast together, and one end cut out about ¾″ so there will be no bearing on the joint, and when the flask is wanted longer, a section is bolted against its flat surface. The objection to this is that the end cut out is never solid on the joint when the flask is used without the extension, and when there is a piece bolted on it the joint forms a flat clumsy surface for the sand to hang to.

The flasks shown are intended for a plain class of green sand work such as almost every jobbing foundry has to do. Deep flasks in some instances are better for being made in sections, and bolted together. Iron flasks for dry sand work are better if made ⅛″ thicker than shown in the cuts, as they have to stand rougher handling.

The cut of a wooden flask shows a good reliable way of making a stiff flask for a medium class of work. The angle piece B is cast iron and is a good thing to put in the corners of large flask for bolting the sides together. D shows a trunnion that can be bolted to a flask, to roll it over, or the two ends could be entirely of iron with the trunnions cast on, and wooden sides bolted to them. When bolts will not hold large flask stiff enough cast iron bars are sometimes used instead of wooden ones, having flanges cast on to bolt the sides and bars together. The handle R is wrought iron to come under the bottom of the cope, and has two bolt holes in it. This makes a reliable lifting hook for very heavy copes.

Should a moulder wish to know the weight of the sand he has rammed up in a flask, in order to tell if the crane or chain is strong enough to lift it, he can remember that one cubic foot of sand when rammed, and of the right temper weighs about one hundred pounds.

The bars can be further apart in deep copes than in shallow ones, for green as well as dry sand. The sides of wooden copes for large flasks should be made of 3″ to 4″ planks. Hard pine will last longer than soft pine, especially if pounded much with a sledge hammer, which should never be done if there are wooden mallets to be had. In making iron flasks the best iron should be used, as a good flask is an essential feature in turning out good castings. They should receive care and proper handling, otherwise, in a short time, a new flask will be only fit for kindling wood or scrap.

Making Metallic Splices.

The rapid growth of the consumption of wire rope for rigging vessels, constructing bridges, and for use in mines, quarries, and for various other purposes, during the past few years has been astonishing. It is not beyond the recollection of the middle-aged person that wire rope was unknown as an article of commerce. Its great utility, however, has now become apparent; its distinguishing features of strength, freedom from elasticity, durability and cheapness having brought it into extended use.

Made up like the hempen rope from twisted strands, the method for joining or splicing two parts of it has, hitherto conformed to the old style adopted in splicing hempen rope, and singular as it may seem no change has been made in it by users until within a very few years, although it has often been found difficult to make the union as strong as the rope. A few years ago with a view to remedying the objections to the old form of splice, Capt. William P. Healey, then of New Orleans, La., a retired sea captain, knowing the difficulty and expense of rigging vessels with wire rope under the common method, commenced a series of experiments and trials for the purpose of finding a suitable and cheap substitute for the old method, and which should be neater in appearance and insure the strength at the splice being always equal to the rope employed. It was not, however, until within the last year that he completed his work in this direction. Knowing that the old method was not well adapted to the largest iron wire rope, and very difficult of application in splicing steel wire rope, he made a complete departure from the old plan. His theory was that the rope might be incased in a metal socket, and held in its place by metal applied in a molten state without in any way dimishing the strength of the rope, a conclusion which experience has demonstrated to be correct. His plan is to make a metallic socket of a cylindrical form in connection with any desired device or appliance for use, as a "round eye," "hook," "block," or "dead eye," or anything that it is wanted to join to a wire rope.

The tube of the socket, with its parallel sides, is just large enough to receive the rope, its length being substantially six times the diameter of the rope, the interior of the tube or socket being tinned. Removing the hemp heart of the wire rope (the length of the socket), the rope in its normal shape is inserted into the socket, and the whole subjected to heat until the socket upon its exterior surface will melt common plumber's solder. In this condition molten metal, consisting of half lead and half tin, is poured into the socket until it is full. So complete is the union formed between the metallic socket and the wire rope by the medium of the solder applied, that every strand of the rope is clasped and held firmly in its place. In the walls of the socket are indents which, together with the spiral form of the rope, serve to prevent any movement even if the union of the tinned sides were to yield under a strain, which is believed to be impossible.

The full intention of the inventor of this plan of securing the ends of wire rope, either together, as in splicing, or to any object as desirable, includes the providing a splice that shall be absolutely stronger than the rope; that shall be neat in appearance, and that shall conduce to safety, in that there is no perishable substance used in connection with it.

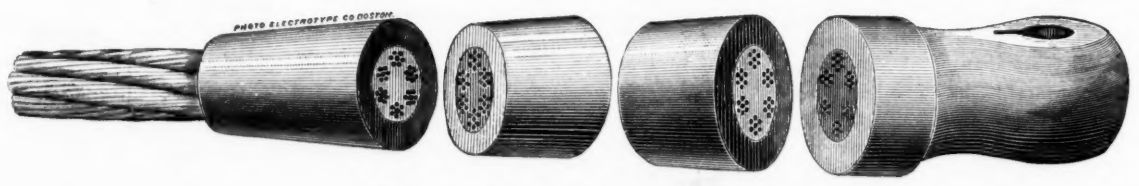
Another important feature is the ease with which the splices can be taken apart and put together again, in case of repairs being necessary. We are informed that tests of rope, both iron and steel, thus spliced have been made, and that the strength at the splices has always been found to be greater than the rope thus spliced.

It is believed that the effect of this invention will be to largely increase the use of wire rope, by doing away with the most serious objections that have hitherto prevented its use for many purposes.

The engravings represent a few of the numerous forms of fastenings, for which we are indebted to the manufacturers, the Metallic Splice Manufacturing Company, 140 Commercial Street, Boston, Mass.

ROUND EYE SOCKET.

DEAD EYE SPLICE.



METALLIC SOCKET IN CROSS SECTION.

About Iron.

BY T. J. BOWDITCH.

Pure iron is almost unknown. What we call iron is that metal combined or associated with other elements, which, though present only in small quantities, may, according to their number and proportion, communicate to it widely different properties. These elements are chiefly carbon, silicon, sulphur and phosphorus, but the most important is carbon.

It is a simple variation in the proportion of carbon, within the limit of about 5 per cent., which causes the metal to appear in the three well-known states of wrought iron, steel and cast iron. As the proportion of carbon increases, the metal passes insensibly through these successive stages.

It has recently been urged that another element, nitrogen, is an essential constituent of steel, but this theory has been hotly disputed. The presence of sulphur is the most frequent cause of *red shortness* and phosphorus of *cold shortness* in wrought iron. One part in a thousand of any of these elements, either separately or combined, will produce a decided effect on the quality of iron; hence the endless diversity in quality of wrought iron, steel and pig iron which is met with in commerce. Then, again, in the case of wrought iron and steel, the quality of the metal may be greatly modified by the mechanical treatment which it has received, and, in the case of pig iron, by the condition under which solidification after fusion has occurred.

It is a remarkable fact that so far as our knowledge extends, iron is the only metal which is capable of acquiring such varied and useful properties by the operation of such simple and apparently trivial causes. One metal is thus made to act the part of several. The defective state of our knowledge of the chemistry of iron is the opprobrium of modern chemists. There is no metal of which the science, properly so called, is less understood.

In the older ages, as now, those best skilled in the production and manipulation of iron held a certain pre-eminence, and in some instances almost the only claim some of the smaller nations had to mention in the pages of history was their abilty to wrest iron from the tenacious grasp of combined impurities, and make it useful to themselves and their neighbors. Iron accommodates itself to most of our wants, in this respect no other metal being of such varied and extended application.

Hyde's Improved Cutting-Off Machine.

Among the recent labor-saving tools of the modern machine shop, there is none more useful than the cutting-off machine. The speed and accuracy of its work, the saving of time, labor and stock in subsequent operations, at once places this machine amongst the important factors in the economy of the machine shop. The cut, page 5, shows an improved tool of this class recently brought out by Warren Haskell & Co., 36 Charlestown St., Boston, Mass., and which it is believed possesses points of superiority that will be appreciated by the practical mechanic.

There are two strong and powerful chucks —one on each end of the main spindle— designed and constructed expressly for this machine. The jaws do not project, consequently the cutting tool can be kept very close to the face of chuck, thereby avoiding the usual strain and leverage on chuck and spindle bearings.

The cones are of ample width and diameter; the bearings of main spindle are large and long.

A special feature of this machine, is the tool post or holder, which is of extraordinary strength and stiffness, and is provided with two lateral adjusting screws so that after once setting the tool perfectly true and square, it can be removed for grinding, and replaced in exactly its original position without loss of time, and without changing its distance from the length gauge. This machine has a cross-feed operated by the usual worm and gear, and also an automatic throw-off which stops the feed when the piece is cut off.

The length gauge is provided with a finger at its forward end, which can be thrown over, after gauging the length, to prevent cramping the tool as the piece drops off.

The counter shaft has two changes of speed, making, with the changes on the cone, six different speeds for the main spindle. The pulleys on the counter shaft are driven by a simple and efficient clutch, so that by an instantaneous movement of the lever, the speed may be accelerated as the tool approaches the center. The "Slate" cutting-off tool and an adjustable stand for the support of long bars accompany the machine. Special effort has been made to entitle this machine to a place in the list of superior modern tools, in the belief that it will fill a place in the machine shop as yet only partially filled.

It is said the transmission of heat through calcareous matter, such as deposits on the plates of boilers, is seventeen times slower than through iron.

LETTERS FROM PRACTICAL MEN.

A Case of Low Water.

Editor American Machinist:

To pump, or not to pump, is a question that is liable to force itself with unpleasant urgency upon the mind of the engineer. Some unavoidable accident or emergency may bring about a condition of low water in the boilers in spite of the utmost vigilance. The exact water line, where safety and danger meet, should be avoided as far as possible, and hence, the good old rule of hauling the fires when water disappears. But a ship in distress, a train in danger, or a puddling furnace full of melted iron under the boilers may present difficulties not contemplated by the framers of the rule. The last named situation was once mine.

Two boilers located over a puddling furnace in a rolling mill were short of water on account of the bursting of the feed pipe. It was a 4" cast iron pipe, and the break occurred about 4 feet underground. Repairs were hastened with all possible dispatch, but in the meantime, steam was blowing off through both safety valves. The break occurred with just solid water at the middle gauge. The two tons of melted iron in the furnace were in the midst of the puddling process. The other boilers of the mill were in batteries of four, but these two had a whole furnace to themselves, and made steam very rapidly. The boilers were of the safest kind, being plain cylinders, with no tubes nor flues. One check valve attached to a screw, with provision for lift, served both boilers. There was no danger of the water shifting at any time, as there was a good equalizer on the boilers.

When the repairs were done, the superintendent of the works asked for my report on the situation. I told him that I had timed the disappearance of the water from the middle to the lowest gauge, and on that as a basis, the water was about four inches below the lowest gauge, and that would bring it about to the fire line, but the steam was not superheated and had no absorbing capacity to cause fear.

I took the piling board that I had been using and wet it in the water bosh, and then let steam upon it from the top gauge cock.

The steam did not dry the board. I told him that I thought safety lay in the direction of pumping, otherwise, the time would soon come when the steam would be superheated, the plates weakened by heat, and the safety valves be insufficient.

The superintendent agreed with my views of the case.

I closed the valve in the steam pipe, thus separating these two boilers from the main steam pipe, so that when I should start the engine, the rush of steam would not cause the water to rise suddenly over the hot plates of the boilers. (The pump was connected to the working beam of the engine.)

I screwed the check valve down, put the pump on another set of boilers where there was plenty of water, and stationed an assistant there at the check valve, and then went to the imperiled boilers and started the screw over the check valve very carefully, and signaled my assistant to gradually close down on his valve. With a packing hook between my teeth I listened for the "click" of the valve, and not hearing it, I signaled for more pressure, and slackened up more on the screw; then came a faint "click." I let it work at that a little, and then gradually admitted the full volume of the pump. The danger was over, and no damage was done.

Defiance, O. ANTHON.

Fast Melting.

Editor American Machinist:

I read the article of Thomas D. West on fast melting, in your issue of Jan. 21. I presume it would interest others as well as myself if Mr. West had given a little more of the details of the arrangement that produced such good results as he narrates.

I would like to know what pressure of blast

in ounces per square inch he used; what he used to produce the blast; how it was driven —whether by belt or gears, and a description of the driving machinery, speed, &c.

I would also like to know the size and length of the conducting wind pipes, the number, form and area of the tuyeres that admitted the air into the charge, and the height from the bottom of cupola that the wind entered the charge. I would also like to know the form of the cupola inside, whether it was a straight cylinder or what it was. I think this information would gratify many of your readers. R.

Economy in Melting Iron.

Editor American Machinist:

The contributions on Iron Founding and Iron Melting by Thomas D. West, Edward Kirk, and others, that have appeared in the AMERICAN MACHINIST all through the year 1881, and so far in 1882, have given me pleasure and instruction on many points.

After reading Mr. West's reply to Mr. Kirk's criticism on fast melting, I tried what I could do, and, for the benefit of all who are interested in the melting of iron, I will describe the cupola and the manner of charging. The inside diameter of cupola at bottom is 24″; at charging door, 21″; height to charging door from bottom, 8 feet; from charging door to top, 14 feet. There are two tweers 12″ from bottom, and each 4″ diameter, and one No. 5 Sturtevant Blower. I first had the cupola properly daubed with clay and sand. (I mean by this that no hollows were allowed in it.) I then put up the bottom, put in three shovels full of sand, and enough wood to dry the lining. After the wood was burned out, I dropped the bottom, and, as soon as the cupola was cold enough, I went in and daubed up all the cracks that were in the new daubing. This being done, I put up the bottom again, fastened it securely, and filled up with moulding sand to within 7″ of the tweers; made up the breast or front, leaving a tap hole 1¼″ in diameter; put in half a bushel of shavings, 60 lbs. of dry wood, 35 lbs. of coke, 100 lbs. of hard coal, and 100 lbs. of coke. At 2.45 I started the fire, and at four o'clock I commenced charging, putting in 250 lbs. of Hanging Rock pig iron, 200 lbs. of Summerlee pig, 400 lbs. of scrap iron, 35 lbs. of coke, 300 lbs. of scrap iron, 200 lbs. of Hanging Rock, and 260 lbs. of Summerlee. I put on the blast at 4.25, and at 4.30 melted iron was running at the tap hole. The second charge was 70 lbs. coke, 500 lbs. scrap, 200 lbs. Hanging Rock, 35 lbs. coke, 200 lbs. Summerlee, and 500 lbs. scrap, The third charge was: Coke, 35 lbs.; Hanging Rock, 200 lbs.; Summerlee, 150 lbs.; scrap, 500 lbs. I dropped the bottom at 5.05 o'clock.

The iron melted in 40 minutes was 3,800 lbs., with 310 lbs. of coke and 100 lbs. of coal, making 9¼ lbs. iron melted to one pound of fuel. No iron was left in the cupola unmelted. I do not claim this to be a safe working quantity of fuel, but I do claim that 7 to 7½ lbs. of iron should be melted for every pound of fuel.

The heat that Mr. West describes has taken one of fuel to 5½ of iron. He says his plan may not be practicable. As to the melting of the iron, it is a success; but the quantity of fuel used makes it a very expensive heat, for, in place of using 1,430 lbs. of coke for 8,000 lbs. of iron, 280 lbs. less would have been sufficient, thus saving this amount of coke every day. I believe, if Mr. West would pay strict attention to the cupola himself for a few heats, he would be able to save the company enough coke to pay the wages of a good cupola man; and if he will put his coke directly under the iron, in place of building the iron around the coke, he will have as good a result with 1,150 lbs. of coke as he did have with 1,430 lbs.

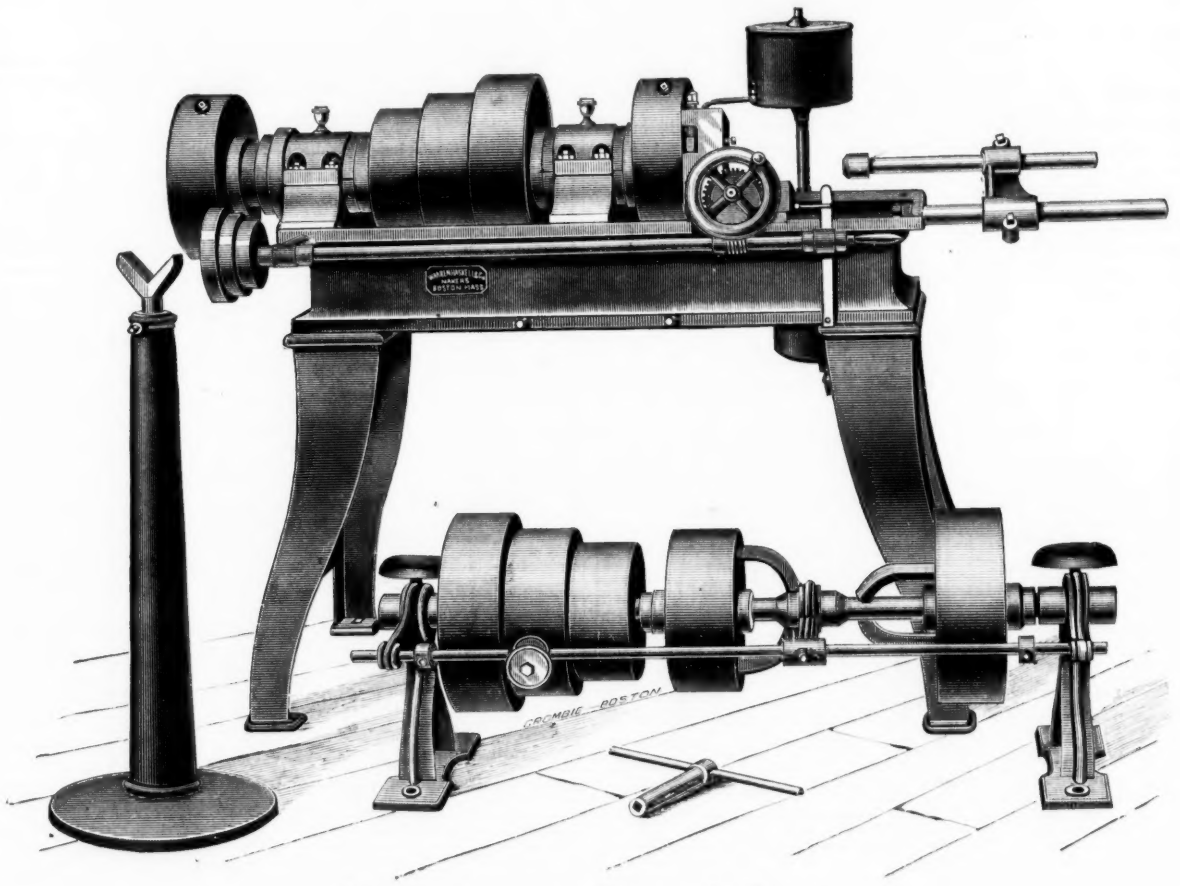
The saving of fuel is a matter of little importance in the minds of cupola men. If the foreman orders a certain amount of fuel and iron for a heat, and will take the time to weigh the fuel and iron after it has been weighed by the cupola man, he will find, almost invariably, from 75 to 150 lbs. more fuel than he ordered, and from 100 lbs. to 300 lbs. less iron. Why this is so I can explain in no other way than by assuming he is afraid he will make a failure of the heat, and so keeps on in this way until he begins to think he cannot melt without he has all the fuel the order allowed, and then as much more as he can conveniently appropriate. Cupola men should be of good, sound judgment, and honest enough not to set fire to their employer's residence. I do not think any cupola man is mean enough to do this, and yet the man who throws into the furnace from $2 to $5 worth more fuel than is needed, day after day, is doing that which is equally as destructive to property. If it is through ignorance, he ought to be watched and instructed until he fairly understands that, when he is handling fuel he is, in a measure, handling the pocket book of his employer.

Mr. West says, there are no practical hints in published works on the true cause of fast melting, to which Mr. Kirk takes exceptions, and being the author of works on the subject, he naturally steps to the front to defend himself and his brother authors. Many would be led to believe that Mr. West was mistaken, because Mr. Kirk is quoted as one of the standard authorities. But I can safely say, with Mr. West, and without fear of successful contradiction, that there is no practical work on the melting of iron. I mean by practical work, a work by the use of which any intelligent man unacquainted with the melting of iron, can construct a cupola and melt iron successfully.

Mr. Kirk, I believe, is an honest man, and undoubtedly believes that his work which was published in 1878 is practical, but he is mistaken. In proof of this assertion, please turn to pages 332 and 333, vol. 1, of Appleton's Cyclopædia of Applied Mechanics, and read with care his two test heats, March 24 and 25, 1876. You will see that he melted 6,069 lbs. of pig iron, using 2,002 lbs. of lump coal—nearly one of coal to three of iron. If the company hired Mr. Kirk as an expert to give a few tests, and instructions for their own good, they got hold of the wrong man; for in place of using 2,002 lbs. of coal, 800 lbs. would have been sufficient; so it will be seen in his two test heats he used 2,404 lbs. more coal than should have been used. If the parties for whom Mr. Kirk made these tests, are still melting iron as he instructed them, the only reason I can assign for their existence is, that they own a coal mine, and are running a foundry on the Kirk plan so as to induce others to adopt the same plan for the purpose of disposing of their coal. Be this as it may, Mr. Kirk has learned a great deal about melting iron between the years 1876 and 1878, which shows that he is a progressive man. If you have his work, please read his description of cupolas; if not, please see Appleton's Cyclopædia of Applied Mechanics, page 875, where he gives directions how a cupola should be arranged. But I won't attempt at this time to criticise his cupola. He says, that the cupola constructed as shown in figure 1859, (Appleton's Cyclopædia) has been known to melt from ten to twenty tons of iron per day, only using 120 lbs. of coke per ton. The reader will have no trouble to discover Mr. Kirk's progress, for in place of using one of coal to three of iron, as he formerly did, he now only uses one of coke to 16 of iron. Of two evils, it is said to be wise to choose the least; but which is the least? The first makes it only a question of time when the best iron company in America will fail. The last is an immediate failure so far as melting iron is concerned. Mr. Kirk could not take off a heat with the last-named proportions of coke and iron, however much it is to be regretted that he fails to fill the bill.

A so-called practical treatise on casting, by N. E. Spretson, was published in London in 1878, a sample of the contents of which is to be seen in Appleton's Cyclopædia of Applied Mechanics, page 333. I am sorry to say that there is not the shadow of practice in it. Overman's Founder's Pocket Guide is said to have a full description of melting iron. From pages 202 to 210 he describes the cupola. He says, if iron is to be melted, the thing to do is to lock the iron door, and fill up with sand. The fire is lighted by a few sticks of wood and some coal or coke. (*How much is "some?"*) After it has burned a little the furnace is filled to its mouth with fuel. (*The higher the mouth the more fuel.*) Read on and you will find you know less about melting iron at the end than you did at the beginning. The latest work on iron founding, I believe, is Iron Founding, by Claude Wylie, but it must be classed with the other impractical work. There are many good things in all of these books, and the authors may have in their minds that which is economical and practical on iron melting, but they have failed so far in putting it intelligibly in print, and have equally failed in their actual demonstrations, allowing their own works to be their judges. JAMES M. WISHART,

Foreman for Craver & Steele's Harvester Works, Grinnell, Iowa.



IMPROVED CUTTING-OFF MACHINE.—See Page 4.

Fitting Keys in Shafting.

Editor American Machinist:

In your issue of January 28, a correspondent gives proportions for, and methods of, fitting keys in shafting, to which I would take some exceptions. As the writer has been forced in the unrelenting school of experience, to abandon some ideas on this, and many other subjects, that were entertained during apprenticeship, a few words of caution to the young mechanic might be proper.

We might divide keys into two classes:

First, when the key secures a freely-fitted wheel to a shaft, and only transmits a portion of the power transmitted through the shaft. Second, when the key secures a tight-fitted wheel to a shaft and the entire force exerted through the shaft is transmitted through the key. In the first instance, if we make the key a driven fit, bearing top and bottom, we will be sure to spring the wheel it secures, and it will run "out" as much as the freedom of fit will allow its bore to elongate diametrically under the wedging action of the key. In such a case the judicious workman soon learns to fit the key on the sides only, and to use such precautions in side-fitting as will secure the desired result without distorting the work.

But when we have a key of the second class, transmitting the whole power of the shaft, we must have, not only the wheel hub a forced fit, but the key must also be a forced fit, bearing rigidly on the four sides, and furthermore, if the length of the wheel hub does not considerably exceed the diameter of shaft, it will be found the safest practice to use two keys, placed thirds of the circumference apart. The length of hubs and keys should be very liberal, in the case of machinery subjected to sudden alterations of speed, such as rolling mill fly-wheels, &c., and most especially if the motion is suddenly reversed in direction.

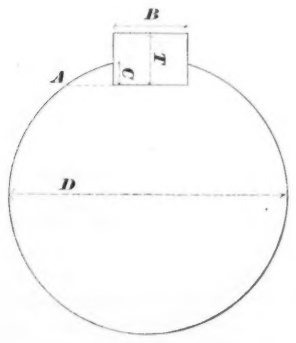
A brief examination of the theory of the key will show, how it is apt to have insufficient side-bearing surface. Very common proportions are, width of key B, equals one-fourth the diameter of shaft D. Thickness, T, equals eight-tenths of B.

Take the case of a 6″ wrought iron shaft, $B=1\frac{1}{2}$″, T 1.2″. This shaft can safely transmit power, causing a tangential straining action at its periphery = 120,000 lbs. Wrought iron has an average elastic limit of about 25,000 lbs. per square inch. This key would, therefore, be not less than 3½″ long to be within the elastic limit, and have the requisite longitudinal section to resist the shearing strain. But the crushing strain is all exerted on a side, $C = \frac{T}{2}$, and in this case we would require a key 8″ long to provide 5 square inches of surface, and then the material would be on the verge of failure, being strained up to the elastic limit. The slightest freedom of fit allowing accelerated action, would speedily destroy the fit, if it was free to bulge top and bottom.

Hence, the inutility of making the key

unnecessarily wide, as by doing so, we positively reduce the bearing surface *C*, and hence, also the necessity of the forced fit of both hub to shaft, and key to slot. The material of shaft not being allowed to shear towards *A* as in dotted lines, nor the key to bulge laterally, it could not yield except by its material flowing lengthways, and we could rely on its enduring a pressure of much greater intensity than before stated, but which would depend too much on the length of the key and the solidity of the fit to give any value. J. C.

Pencoyd, Pa.



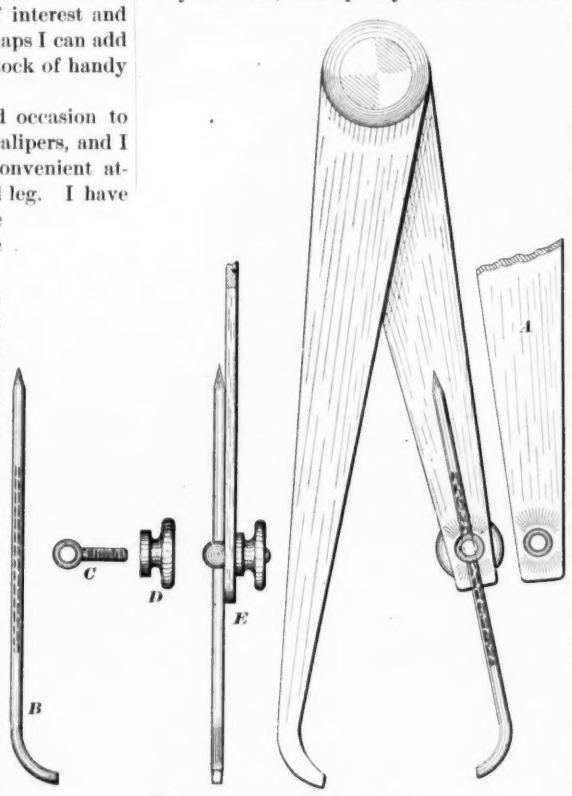
Hermaphrodite Calipers.

Editor American Machinist:

I have read in your most excellent paper the "Shop Kinks" and "Letters from Practical Men," with a great deal of interest and profit to myself, and think perhaps I can add a mite to a knowledge of the stock of handy tools.

Three or four years ago I had occasion to make a pair of hermaphrodite calipers, and I added, what I think, a very convenient attachment to the sharp-pointed leg. I have found it so useful that I enclose you a sketch which I have made of it.

The arrangement was original with me, and, although it may not be new to some, I have examined a good many tool catalogues, and have not seen any device that it would infringe upon. It differs from the usual extension-point dividers, in that, in measuring almost to its full scope, the adjustable point may be set perpendicularly with the surface of the work, thereby producing a finer and more accurate line than if it were oblique, as when straight with the leg. The universal feature presents a great many advantages over the ordinary hermaphrodite calipers; for instance, they may be used as inside or outside calipers, or in or out hermaphrodites; or the feet of both legs may be turned in the same direction. (By the way, I believe there was a tool illustrated in the AMERICAN MACHINIST some time ago fixed in that way.) As the sharp point is made shorter by grinding to sharpen, it does not require the services of the blacksmith to make it the same length as the other leg. But I have puffed my own work enough, I reckon. I believe this tool has only to be used to be appreciated.



HERMAPHRODITE CALIPERS.

Referring to the sketch: The hole through the end of short leg *A* is countersunk for the head of the eye-bolt *C*, sufficiently deep to allow the scriber *B* to be clamped tight against the leg when the thumb-nut *D* is screwed up. *C* is the eye-bolt through which the scriber is thrust. The end of the leg around the hole is scored with chisel marks, radiating from the hole.

The scriber is ground flat on each side, so that it may be turned either way. It is also scored, the marks running longitudinally. This is done to make it more difficult to move when set. *E* shows another view of the adjustable leg.

The scriber is made of a piece of steel wire of convenient size and length, with one end pointed, the other bent to form the foot for caliper leg. D. J. JUSTICE.

Raleigh, N. C.

Simplifying an Electric Alarm Tank.

Editor American Machinist:

I notice in the AMERICAN MACHINIST of the 14th of January a sketch of an electric alarm for water tanks.

I would suggest to Mr. Lewis that, instead of making a lever, float and key board, he merely place the ends of the wires (insulated) in the tank—one at the height that he wishes the water to be, and the other a little lower. The water in the tank will rise till it covers the two ends of the wires, thus making the connection and ringing the alarm.

H. P. DYER,

Engineer Standard Sugar Refinery, Alvarado, Cal.

Hinges in Split Pulleys.

Editor American Machinist:

To take exception to anything appearing in your paper from such good authority as Prof. John E. Sweet, will, I suppose, be looked upon as rank heresy, but never-theless, that is what I shall do.

In the Professor's article on Mechanical Drawing, in your issue of January 21, he says, in speaking of split pulleys, "The later method of joining the ends of the rim is less unsightly than the old way, and by removing one of the pins the two halves of the pulley may be *opened like a door hinge* and placed on the shaft much more conveniently than if completely separated."

That door-hinge assertion must have slipped in by accident, as no pulley that I have ever seen made on this pin plan, as drawn by the Professor, could be opened like a hinge, as a moment's thought would convince anybody, even if they had never made the attempt in practice.

In the Professor's sketch of a split pulley, the rim shows a break at the right hand joint, and in a pulley so made, this hinge idea would be all right, but the pulley would be worthless.

Perhaps this may be thought a very trivial matter, as an attempt to open a pulley with one pin in the rim-lugs would not do more than break it, at most, but my contradiction of this very assertion once placed a very large job in my hands. Yours truly,

Bridgeport, Conn. WM. D. FORBES.

Where Our Flannels, Blankets and Carpets Come From.

The United States produces nearly all the flannels, blankets and carpets we use, nine-tenths of the woolen shawls, fancy cassimeres, suitings, coating and hosiery we wear; two-thirds of the worsted dress goods; four-fifths of all the wool our country needs, and more than four-fifths of all the woolen fabrics worn by our people. Not one American in twenty but is clad from head to foot, out and out—his coat, boots, hat, linen and flannels, his watch, his knife, his pencil, his gloves, his jewelry—each and all are American products.—*The Tradesman.*

Shop Systems of the Yale Lock Mf'g Co.

We are indebted to the courtesy of Henry R. Towne, President of the Yale Lock Mf'g Co., Stamford, Conn., for the following explanation of some of the admirable methods of shop management which have grown up in that establishment during the past fifteen years. These systems are the work of Mr. Towne and his able associates, and their application has resulted in the rapid dispatch of business, the avoidance of confusion and worry, and the saving of a vast deal of labor, time and money.

The company's lines of manufacture are three-fold, viz., Locks, Hardware, and Hoisting Machinery, each branch covering a wide range. The systems here described, were devised and introduced at different times, as special need or opportunity developed, but an establishment desiring to profit by the experience of this company should, perhaps, begin by preparing and posting up a number of convenient boards, say, 10 inches high by 15 inches wide, in every part of the works, upon which is pasted a *System of Order Numbers*, resembling that here shown.

[To save space, we copy all the blanks needed to describe these systems in the smallest compass possible.]

SYSTEM OF ORDER NUMBERS.

CLASS A.

1. Small Locks, includes all Time and Materials on Yale, Standard, Pad, U. S., American and Prison Locks, Bronze Goods and T. Handles, Gate Fixtures, Purchased Goods; Post Office Locks and Fronts, and Street Letter Boxes.

2. Store, includes all Goods and Materials for Store.

3. Johnson Locks, includes all Time and Materials for Johnson Locks and Keys.

4. Brass Foundry, includes all Time and Materials for Brass Foundry.

6. Knobs, includes all Time and Materials for SCREWLESS Knobs and Sp'ndles only.

7. Battery, includes all Time and Materials for Plating, Buffing, Dipping and Lacquering in Battery Rooms.

8. Wheel Room, includes all Time and Materials for Wheelroom.

CLASS B.

10. Pulley Blocks, includes all time and Materials on Pulley Blocks.

11. Hoists, includes all Time and Materials on Double Lifts, Crabs, Winches, [except those for Cranes], Elevators, Etc.

12. Cranes, includes all Time and Materials on Traveling and Jib Cranes, Derricks, Transfer Tracks, Travelers, &c., also, all Crabs, Trollys, and other parts for same.

CLASS C.

20. Dial Locks, includes all Time and Materials on Dial Locks of ALL kinds.

21. Time Locks, includes all Time and Materials on Time Locks.

CLASS D.

30. Safes, includes all Time and Materials on Safes, and on Attachments for same. [Locks to be charged at Fixed Prices].

CLASS E.

40. Post Office, includes all Time and Materials on Post Office Wood Work, and on Fittings for same. [Locks and Fronts, and also Street Letter Boxes, to be charged at Fixed Prices.]

CLASS S.

60. Running Expenses, includes Fuel, [except for Foundry], Gas, Water, Oil, Insurance on Works, Watching, Fire Inspection, Time and Materials for Running Engines, Oiling Shafting, and Sweeping; also ALL Repairs to, or mere alterations of Buildings, Fixtures and Machinery, and Erecting and Moving Shafting and Machinery.

61. Office Expenses, includes all Expenses of Office, Salaries, Stationery, Etc., and alterations and repairs of Office Furniture.

62. Advertising, includes Sample Boards and the Mounting of Goods thereon, Key-Signs and all Expenses of Advertising. [Except "Directions," which charge to Order Number covering kind of goods to which they relate.]

63. Trucking.

CLASS X.

70. Machinery, includes all NEW Machinery operated by Power, Foot or Hand, and any additions, of permanent value, to the same.

71. Tools, includes all NEW articles of the following kinds, viz. Special Tools, Hand and Lathe Tools, Special Fixtures for Machines, Drills, Cutters and Mills, Work Trays and Boxes, Tables, Emery Wheels, etc.

72. Fixtures, includes all ADDITIONS AND IMPROVEMENTS, but NOT repairs or alterations of Fixtures, viz: Shafting, Partitions, Benches, and all Office Furniture, Engines, Boilers and piping of all kinds, Call Bells, etc.

73. Patterns, includes Time and Materials for all NEW Patterns.

CLASS Z.

80. Building, includes all Time and Materials on NEW Buildings, or Additions.

All Time and Materials for the following items to be charged to such of the above Order Numbers as cover the kind of Goods to which they Relate, viz:

Packing and Shipping, Job Work, Experiments and Models, Alterations and Repairs of Patterns, Repairs and Renewals, Of Special Tools, Drills, Cutters, Files, Emery Cloth, &c.

☞ When a special "Factory Order" is issued, all Time and Materials are to be charged to ITS NUMBER, instead of the Regular Numbers above.

In this table of "order numbers," classes *A*, *B*, *C*, *D*, and *E*, embrace the producing departments, in which the several kinds of manufacture therein specified are carried on, including all accounts of time and materials used, and everything that enters into the cost of the goods produced in those departments, except *General Expenses*, as comprised in Class *S*, and *Equipment* and *Buliding* accounts, as comprised in Classes *X* and *Z*. The numbers at the left refer to divisions within those departments, as, for example; John Smith works in No. 1: meaning, that John Smith is employed in the particular division of Department or Class *A*, in which the locks and other goods mentioned are manufactured. Materials and supplies wanted for and used in this Division, are ordered charged to the proper designating numbers. Everything manufactured in this division is charged to order "No. 1."

Numbers 60, 61, 62, 63, etc., in Class S, refer to the items of general expense there specified, and in all final computations form an element of cost in all goods produced.

Numbers 70, 71, 72, 73, etc., refer to the various expenditures for new machinery, tools, fixtures and patterns which are required for the work of the producing departments, a suitable allowance for depreciation in value each year, owing to wear and tear, forming, likewise, an item of cost in production.

No. 80, of Class *Z*, refers to expenditures for buildings, etc.

A suitable percentage for interest on the investment accounts, comprised in Classes X and Z, also forms an item in computing the cost of manufactured goods.

In other words, the various "numbers" and "classes" in this table are treated as individuals in the books of the company.

Here may be explained a simple device which is applied to all circulars, blanks and printed matter used by the company, viz.: In the upper left-hand corner of each blank are printed small figures symbolizing the number of the blank, when it was printed, the number of blanks printed, and, in many cases, the cost of the blanks. Thus:

$$\frac{397}{6.81}\ \frac{5}{.35}$$

would indicate that the blank was numbered 397: that it was printed June, 1881; that the number printed was 500, and that the blanks cost 35 cents per hundred. This supplies a ready method of designating any particular blank, together with other convenient information regarding it, and saves much time and trouble.

Another simple and kindred device, which saves much time and confusion, consists in the use of a different colored pencil for notation purposes by each officer of the company. Thus: Any communication, bearing any kind of query or check mark in *red*, is known to be from the president of the company. A letter or paper marked in *purple* is identified throughout the works as coming from the secretary. A green pencil mark indicates the treasurer, and a yellow mark the superintendent. In all the business of the company these colors are reserved for the use of these officers exclusively.

Each of the executive officers is also provided with a small pocket punch, like a railway conductor's punch, making a peculiar and distinct mark, and, when he punches a document, this is considered equivalent, in all shop matters, to signing his name in approval of the document punched.

Orders for goods wanted for shipping are made in the office by means of a blank, the heading of which we append. These blanks are filled out and delivered to the superintendent, who forwards them to the foremen in charge of the various departments.

391 / 5.81 / 5

SHIPPING ORDER.

No.....(Date).....Shipped.....by.....
Ship via.....Charged.....
To .....
.....

Whenever, in making such an order upon the superintendent, the office desires to know *when the goods will be ready to ship*, a simple question mark—thus, ?—is made on the order in colored pencil by the proper officer of the company. This is at once understood as meaning that the officer making this mark desires to know the precise date upon which the goods will be ready for shipment.

Immediately upon receiving a "queried order" (blank No. 391), the perforated blank No. 385 is filled out in the superintendent's office, and the regular shipping order is pinned over it, leaving about 1¼ inches of the left-hand margin uncovered (the right-hand portion of blank No. 385 having been previously torn off by the superintendent and retained by him for reference), and the two are sent in this condition to the foreman in charge of the proper department. On receiving the blanks thus arranged, the foreman writes on both the upper and lower portions of blank No. 385, under the word PROMISED, the date on which the goods can be shipped. He retains the upper portion, together with the original, or detailed order (blank No. 385 being only filled out in memorandum form), and returns the lower portion to the superintendent, who, from the date thus given, is enabled to fill out the memorandum on his file. The superintendent then returns the lower left-hand portion of blank No. 385, thus filled out, to the office.

When the goods thus ordered in any department are ready for shipment, the foreman returns the shipping order (blank No. 391) to the office, returning at the same time the remaining (or upper left-hand) portion of blank No. 385 to the superintendent, indicating that the order has been executed.

It is obvious that from a daily inspection of the memoranda thus placed upon his file, the superintendent is able to determine what "promised" orders are due from the several foremen upon any particular day. These memoranda are finally turned into the treasurer's office by the superintendent, and eventually destroyed.

As a result of this method it is found that orders are very seldom delayed beyond the date promised for their completion, a circumstance of the utmost value in any manufacturing business.

It sometimes happens that "special haste" is necessary in executing a certain order. In such cases, blank No. 348 is used, the orders having *precedence* in every department of the works over every other order, excepting, of course, other "special haste" orders.

348 / 10.80 / 3

YALE LOCK MFG. CO.,

STAMFORD, Conn.

Date.....
.....
..... are in

SPECIAL HASTE.

If anything stands in the way, in any room, of their being done promptly, let the Superintendent know AT ONCE.

As soon as the work is done in one department, SEND without delay to the next in order,

WITH THIS SLIP ATTACHED.

When regular stock goods are wanted, a shop order is made out (in round numbers) on blank No. 384, and handed by the superintendent to the foreman of the proper department. (In the present illustration, department No. 1, Class *A*.) The foreman completes the blank by noting the number of articles actually made, with date of completion, and the goods, accompanied by the shop order, are turned over to the inspector, who finally returns the completed order to the superintendent. We append a specimen blank.

385 / 6.81 / 5

Return to Superintendent when Sending Shipping Order to Office.

Promised.

No.....
.....
.....
.....

Promised

.....

No.....
.....
.....
.....

Promised

.....
No.....
.....
.....
.....

Promised

.....
No.....
.....
.....
.....

Shipped.

.....

One of the most vexatious and time-consuming features possible in any business is want of system, in the matter of asking and answering the thousand-and-one inquiries that are liable to come up in daily business. To prevent this wholesale waste of time and disarrangement of business on the part of both *questioner* and *questioned*, blank No. 436 is used, of which the heading is here given, space being left for the questions and answers.

436 / 12.80 / 24

YALE LOCK MFG., CO. | INQUIRY. | Use a Separate Sheet for Each Inquiry.

NOTE.—To facilitate business, and to avoid interruptions, ALL inquiries not requiring instant action, and which can be stated BRIEFLY in writing, should be made in this form and handed into the office.

To..... 188

The above blank is usually addressed to the foreman of the department, or may be addressed, for example, simply to "10," which is at once understood as meaning the foreman of the Pulley Block department. These, and other errands are served by messenger boys, who make regular trips throughout the various departments, rendering it unnecessary for any employe to leave his work, in working hours, except in extreme cases.

In the arrangement of wages, confusion is avoided by the use of blank No. 383, here given, the final approval being usually by the president, who estimates that a few minutes in each month is all the time required of him for this purpose under this system. The blanks come to him uniform in size, and filled out and signed by the foreman and superintendent. He readily lays aside and returns to the superintendent for further investigation, any recommendations that seem doubtful, and punches all the others at one time and by one motion, in token of approval.

383 / 5.81 / 5

WAGES RATE TICKET.

.....188....

I hereby recommend that the wages rate of .....
.....
employed as a..... .....
be fixed at.....cents per hour from .....
His present rate is .....cents, which was fixed..... .....188.....
prior to which it was.....cents. Age (if a minor,)..... ...

I have examined the case carefully, and am satisfied that his services are fully worth the proposed wages, and that the latter are no higher than the Company is paying to others or similar services.

.....
FOREMAN.

I have personally investigated the above case and advise its approval.

.....
SUPERINTENDENT.

Approved:
.....

FOLIO..... No.....

In the cases, where piece work is done, the prices are arranged by the use of a similar blank, and the rates thus fixed remain unchanged for *one year*, after which they are again subject to revision.

Edison's latest wrinkle is the attempt to convert coal directly into electricity without the intervention of the steam engine, and with special reference to his system of electric lighting.

YALE LOCK MFG. CO.

Order No. STAMFORD, January 15, 1882.

Charge all Time and Materials to the above Order Number.	Make Order on Store Room at once for all Materials needed.	As soon as the Work is done, return this Order to Super'd't.

To	Deliver to.....Stock.....	Number Made.
	5,000 Rim Latches No. 42.....	4912
.....		.....
.....		

384 / 5.81 / 5.

Page, 12, Catalogue No. 7. Date when Finished, January 25, 1882.

Messrs. J. F. Holloway, of the Cuyahoga Works, and S. T. Wellman, of the Otis Iron and Steel Company, members of the American Society of Mechanical Engineers, who came from Cleveland, Ohio, to attend the funeral of the late A. L. Holley, unfortunately arrived at the church half an hour too late for the purpose. Before starting, Mr. Holloway contributed a feeling obituary of the honored dead to the Cleveland Daily Leader.

The Cautious Reception of New Mechanical Devices.

Only those who have learned by experience, fully appreciate the fact that usually a small part of the difficulty is overcome in the devising and getting an important mechanical appliance ready for use. The inventor may see clearly the advantages of what he has, but to make others see it as he does is quite another thing.

Generally the designer is a man of advanced ideas, added to which, intense application in the direction of his production usually has the further effect of placing him so far in advance of current thought on the subject, that the real difficulty is in educating those to whom he ought to sell up to seeing the matter as he does—which is probably in its true light. While there is nothing in this that might not be expected, it is one of the discouraging features attending the introduction of many things in the mechanical line that are really meritorious. Nothing is more natural than that such things should be looked upon with some degree of suspision by those who are looked after as purchasers; while on the other hand to the man who has studied the matter in all its bearings, it seems entirely unnatural that his presentation of the subject does not carry conviction with it.

Years ago the inventor of an appliance that has since gone into universal use in the machine shop carried one of them around—a job of considerable magnitude—in the vain attempt to convince some one of its utility to the extent of satisfying him that it would be to his interest to buy. So far from accomplishing his purpose, he returned home in disgust. Familiarity with the use of machine tools, and a correct appreciation of the economic value of his device, did not apparently supply him with sufficient arguments to satisfy a single individual.

He found, however, upon arriving home, that in one instance he had talked to better purpose than he knew of, the evidence being in the shape of a single order from one of the parties visited. The next thing was to wait patiently for another order, which came from the same parties, but for a different-sized device, for which the inventor made his own patterns, doing the machine work with tools illy adapted to the purpose. After this a long spell of waiting.

It is altogether pleasing however to record that from this beginning—by no means encouraging—a business grew up that has amply rewarded the party referred to, and has been indirectly of infinitely greater advantage to others than to him.

This is by no means an exceptional instance, but on the contrary is the usual course, and instead of discouraging those who have valuable ideas should afford encouragement, and the satisfaction that comes of merited approval. The caution with which mechanical devices involving radical changes are received does not, as is sometimes claimed, work entirely or usually to the disadvantage of the inventor. On the contrary, the fact that such devices must find their way into public estimation on their own merits, although it may sometimes delay the triumph of valuable inventions, is in the end a protection to the possessor of things really meritorious.

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NEW YORK, FEBRUARY 18, 1882.

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Alexander Lyman Holley.

Elsewhere we present a portrait of the great engineer for whom two continents mourn, our illustration being from a photograph taken about two years ago.

The qualifications of this remarkble man were so many and so varied, that it is impossible to do justice to his memory within the limits of our space. Many men have been eminent in a single department of engineering. Few have won eminence in several distinct branches as Holley did. Railway, marine, naval and metallurgical engineering, in a variety of ways, owe to his tireless activity contributions of the greatest value. Many men have attained mechanical eminence as a result of practical work. Few have added the polished diction of the thoughtful and witty speaker, the case of the non-official dioplomatist, the grace and learning of the scholar and the skill of the ready writer to the undoubted claims to practical eminence which Holley was too modest to make, but which his deeds abundantly made for him.

Many men who have achieved eminence in special lines, have been so unbalanced in other directions, or so honeycombed with human weakness, that always the veil of kindly charity was needed for their shortcomings. But Holley never needed coaxing, or flattering, to keep him in line with any worthy movement. On the contrary, he held others in line. In point of fact, some of Holley's most characteristic qualities centered in the personal influence and tact with which, without being a politician or public man in the ordinary sense of that term, he moved the springs of public opinion in industrial—notably tariff—matters, in ways for which few persons have ever given him credit. His extended acquaintance among engineering societies, schools and establishments, as well as railway and transportation circles, and his personal and social relations with influential men and leading journals, form a case in point.

One of the distinguishing features of his character was its *genuineness.* Refusing to accept a degree from another institution, he yet valued the similar distinction conferred upon him by his *Alma Mater,* Brown University. Receiving the congratulations of a friend upon this high compliment, his first thought was, "Yes; but I must now go to work and deserve it!" This from a man whose graduation from any college must honor it more than school or college could ever honor him!

Many men possessing great mechanical endowments never discover or create anything, because they do not go where things are to be discovered or created. Rooted in one place, they spend years in doing something that has been better done elsewhere. Or they cannot make others believe in their entire knowledge and mastery of the subject. Holley's short life produced great things, because he lost no time in doing incomplete or useless things. His incessant travels taught him the boundaries of every man's land, and he learned exactly where to begin building. In this, too, his tact and personal good fellowship made the task of acquiring knowledge easy. He asked information, and he gave it liberally and frankly; and in these ways gained admittance freely to establishments that would have been bolted and barred to most other men. Incapable of betraying confidence, all with whom he was brought into contact learned to feel a personal affection for him.

He was one of the most appreciative of men. He readily grasped the full scope and effect of any new thing when first presented. He looked at once to the bottom of it, and needed neither explanation nor argument, but if he accepted it, did so wholly and without reservation. His ready acceptance of the idea of establishing the American Society of Mechanical Engineers, in the manner proposed, is a case in point. Without a trace of meanness in his composition, he was equally without recklessness, His moral nature was as rounded and complete as his mental endowments, and indeed formed a part of them.

The only pity of all, was the fact that in his devotion to the work which he so loved, he considered his work so much and himself so little. Accomplishment was easy to him, but human strength has its limits. The final result of this process of lowering the vital forces by ceaseless work and study, deplore it as we may, cannot perhaps be better characterized than in his own words, speaking in steel-making phrase, upon a happy occasion some years ago:

"Burn to the end—perhaps some of us should think of that, who are 'burning the candle at both ends.' Ah! well, may it so happen to us that when at last this vital spark is oxydized when this combustible has put on incombustion, when this living fire flutters thin and pale at the lips, some kindly hand may 'turn us down,' not 'underblown'—by all means not 'overblown'—some loving hand may turn us down, that we may perhaps be cast in a better mould!"

The Science of Steam Engineering.

Notwithstanding the progress that has been made during the past twenty-five years in the direction of perfecting the steam engine, it is at least remarkable that nothing has been added in that time to the science of steam engineering. Remarkable, because the steam engine is confessedly one of the most important factors in the problem of industrial enterprise, as well as in many things that otherwise make up the sum of the comforts and conveniences of life, and as such has received, and is receiving, probably as much serious consideration as any other single thing in the mechanical line.

Not less remarkable than the fact that twenty-five years—one hundred years we might say—has failed to develop a basis for the science of steam engineering, is the fact that such progress has been made in a general direction without any science.

It has long been known that, for instance, there was a gain in working steam expansively, which knowledge must almost inevitably go with any practical knowledge, however rude, of the application of steam, as in the cylinder of a steam engine. In reference to the economic value of expansion, even when employed under pre-determined extraneous conditions, the widely different opinions of eminent engineers demonstrate that much practice must yet precede the establishing of this point in the science of steam engineering.

So with reference to cylinder condensation, which so closely affects the possible economy of expansion. On this point the most diverse and confusing opinions prevail, with no present probability of a crystallization into the germs of exact knowledge.

The value of the steam jacket, and even the advantages of compounding, are hardly less warmly disputed, to say nothing of high rotative speed and minor points.

The fact that these points are in dispute by those whose education—if any one's—fits them to speak with authority, shows more conclusively than argument the condition of existing knowledge on the matters that particularly pertain to steam engineering.

Unfortunately, the things that would collectively go to make up the science of steam engineering are exceptionally hard to come at. Laws must first be deduced from experiments, and experiments that should be of substantial value, have baffled—apparently—thus far the experimenters. Perhaps it would better express the facts to say that these experiments are usually made with a single object in view, and that not always a very clear one. In any event, they do not always satisfy those interested in them, or at least do not afford sufficient data for their own future use; and, of course, if fully known, would be of little value to others. Evidence is not wanting of this fact, while the instance is not wanting where some particular arrangement—notably, the steam jacket—has been demonstrated to be both economical and the reverse in the case of the same engine.

Notwithstanding the difficulty of obtaining information, from experiments as usually made, sufficiently accurate to form a basis for the science of steam engineering; it would seem practicable by an honest co-operation of those interested to arrive at a knowledge of many points in dispute which should be substantially correct—at least sufficiently so to prove of great value. For this purpose the *complete* records of any experimental test—however trifling it may appear—would be of great value.

Messrs. Le Van and Grimshaw, of Philadelphia, of the Committee on Regular Meetings, have made arrangements with the Pennsylvania Railroad officials, by which cards will be furnished to the Secretary of the American Society of Mechanical Engineers (239 Broadway, New York), for distribution among members of that organization, entitling each member desiring to attend the Philadelphia meeting of the society, on presentation of such card at the railway ticket office, to buy tickets over the Pennsylvania Railroad and all its branches, either way, at the rate of *two cents* a mile.

Running Over Time and Double Time.

It is a matter for serious consideration in many machine shops, in view of the pressure of work and the advantage of filling orders promptly, whether it is good business economy to work over-time from one to three hours a day. A large number of shops have tried it and are now trying it, while others could not be induced to try it. We have made careful and extended inquiries in regard to the economy of the plan and find that the experience of at least four-fifths of those who have carried it into operation is that *it don't pay.* Now, if ever, the advantages of the plan should be manifest. Prices are remunerative and orders abundant, the extent of business (and consequently of profits) of almost every shop being limited only by its capacity for production. The delay in getting orders filled is the principal drawback in giving them out. In numerous instances the shop that can fill the order at the earliest date has the preference, sometimes, too, at a higher price than the others can obtain. It is therefore not surprising that some machine establishments feel impelled to work regularly overtime. That as a rule they are not satisfied with the result now is sufficient evidence that, in no condition of business, would the plan prove generally successful. The human machine, unlike inanimate matter, is quite limited in its capabilities for continuous exertion; and efforts to increase the amount of daily work which experience has shown to be reasonable and safe are apt to bring out difficulties of one kind or another. Men who work fifteen hours a day ought not be expected to do one and a half times as much as men of equal caliber who work only ten hours a day. Even if they accomplish the same result for every hour's labor as others who work fewer hours for a short time, the laws of nature will inevitably assert themselves and compel a relaxation. Let a shop commence running regularly overtime, and soon workmen previously relied upon for steadiness will be off for one or two days, or perhaps a week at a time, either sick or taking a rest. When good mechanics are as hard to secure as they are now, it must be a disadvantage for a shop to dispense with any of them for a single day.

We should not, perhaps, say anything detrimental to the quality of the work turned out when a shop habitually runs overtime, but it is safe to venture the assertion that quality is not so likely to be maintained as when men are not taxed beyond the ordinary hours of labor.

The operation of shops well lighted (electric light, for instance), and provided with a double force of workmen—one for day and the other for night work—is not open to the objections we have mentioned. A number of shops are pursuing the latter plan with, so far as we can learn, good success. It almost doubles their capacity to run as long by night as by day, and when gain in time and interest on cost of plant are considered, we are not sure but it fully doubles their profits.

Building Locomotives.

The pressure on locomotive shops for turning out work this year is greater than it ever before has been in our history. It will be months, at least, before the new locomotive works now building at Rome, N. Y., and near Chicago, Ill., will be ready to deliver engines upon orders, to say nothing of the prospect of works contemplated at St. Louis, Louisville, and Youngstown, O. Meanwhile the old establishments are doing their best to facilitate the execution of their orders. Some of them are jobbing out the building of locomotive boilers to outside boiler manufacturers, which hastens along the completion of the engines. One large boiler shop in Boston, we learn, is working to its full capacity on boilers for locomotives.

Our English exchanges note an order recently received from this country by a leading North of England firm for "a considerable number" of locomotives of the American type to be built from designs of James Cleminson, C. E., of London. Mr. Cleminson's systems of locomotives and cars have been used in England for some years with the most gratifying success. In an interesting article contributed by him to the AMERICAN MACHINIST of October 16, 1880, he gave some particulars about the cost, weight and style of construction of the locomotives and cars built from his designs for the North Wales Narrow-Gauge Railway; also cost of running them as compared with another type of rolling stock, from which it appears they were very economical.

Several manufacturers have advanced the price of machine tools since the first of January ten or fifteen per cent. Late advances in the price of iron and the extraordinary demand have been the cause of it.

Nails are made and sold in kegs at a price but very little (if any) above that of refined bar iron. The business has contained in itself a great deal of competition, although prices are regulated by two associations, one east and the other west of the Allegheny mountains. The nail industry might perhaps be considered a losing business, but the returns of the nail mills of Wheeling, West Va., (the Nail City) for 1881, show that it is not so unprofitable as it might be. Seven of these mills have an aggregate capital stock of $3,260,000, and these seven mills earned and paid dividends during the past year aggregating $712,000, or about twenty-three per cent. At the same time the stock in these mills has largely appreciated in value.

The bar iron manufacturers are pursuing a wise policy in not advancing prices to a point where the importation of foreign iron will be stimulated as it was in 1879. The steel manufacturers seem to appreciate the situation in this respect, and have kept prices low, thereby making it very difficult for English steel to gain any considerable portion of the trade lost in this country.

Second Hand Tools.

Three years ago second-hand shop tools were easily obtained of all degrees of wear. Tools could be had in any stage of decay (thereby suiting different tastes and requirements) from the slightly worn to the completely dilapidated article. Now all this is changed. The man who wants a more or less damaged lathe drill, planer or milling machine is obliged to skirmish around considerably to purchase what he desires. The market supply is about exhausted. Prices, however, have not advanced much beyond those asked for new tools. The disappointment of the individual who has been unsuccessfully shopping for second hand tools is often hard to express.

On the morning of the 31st ult., the large structure known as the World Building, on the corner of Nassau, Park Row and Beekman streets, New York City, was consumed by fire, with a loss of about three-quarters of a million dollars and at least six lives. Among the prominent losers are the New York Belting and Packing Co., who lose $150,000, two-thirds covered by insurance. The *Scientific American*, *Manufacturer and Builder*, *Turf, Field and Farm*, *New York Observer*, and several other journals, are also among the losers. The first named journal has secured new quarters at 261 Broadway, and its publication will continue without interruption. Doubtless the other journals mentioned will be equally fortunate. We extend our sincere sympathy to our neighbors in their hour of misfortune.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(52) A. W., Woodbridge, Canada; writes: Can you inform me where to procure the prepared paper used in copying drawings by the blue process? *A.* See full directions for preparing and using this paper in AMERICAN MACHINIST, October 8, 1881.

(53) J. C., Ottawa, Canada, writes: I am a marine engineer, and would like to obtain papers to run on the American side. What steps must I take to do so? *A.* Apply to the Board of Supervising Inspectors in the most convenient locality.

(54) T. M., San Francisco, Cal., asks: Please inform me whether the metal called bismuth expands or contracts when heated? *A.* Generally speaking, it may be said to expand. Bismuth is quite brittle, and is seldom used by itself. It is mixed with lead, which forms a very tenacious alloy that expands in solidifying, and hence is sometimes used for very fine castings.

(55) S., Syracuse, N. Y., asks: On which side of a slide for milling machine or lathe should the gib be placed? *A.* Opinions differ somewhat, if we judge from the practice of different builders. Our opinion is that it should always be placed so the strain of the tool in cutting will bring the greatest wear on the gib. The reason for this is, that the gib is the easiest part to renew; also, the gib being adjustable, the effect of unequal wear remedies itself in the adjusting.

(56) P. B. C., Newark, N. J., asks: Will you please tell me the horse power of an engine of the following dimensions: Diameter of cylinder, 18"; stroke, 36"; revolutions, 85"; steam pressure, 96 pounds? *A.* Such an engine, if properly constructed, should work, with a reasonable margin for governing, at from 140 to 150 indicated horse power.

(57) A. M., Norfolk, Va., writes: I have an arrangement by which I can run two engines, either horizontal or vertical, connected to one shaft, using only one eccentric and one valve. The engines may be compound or simple. The valve is in one piece, self-adjusting to seat or seats, very simple and perfectly balanced. What I want to ask you is, if there is any value in this? *A.* The fact that you make one valve answer for two cylinders amounts to nothing. If you can make a balanced valve simpler and more reliable in its operation than others, either on one or two cylinders, your invention has some value.

BUSINESS SPECIALS.

Transient advertisements 50 cts. a line for each insertion under this head. About seven words make a line. Should be received Wednesday morning.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O.

Presses and Dies. Ayar Mach. Works, Salem, N. J.

Alfred Wilkinson, Expert Tests of Steam Engines and Boilers, 123 N. 4th St., Phila.

List of Machinists in U. S. and Canada; just compiled. Price $10. A. C. Farley & Co., Philadelphia.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

"To stop leaks in Boiler Tubes use Quinn's Patent Ferules. Address, S. M. Co., South Newmarket, N. H."

Boilers improved in steaming power, fuel saved; payment proportional to improvement. R. GRIMSHAW, 430 Walnut St., Phila.

Mechanical drawings, machine designs, tracings and Patent Office work. A. J. Emery, Mechanical Engineer and Draughtsman, 58 Liberty Street, N.Y.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Book sent free by the publisher, Jas. F. Hotchkiss, 84 John Street, N. Y.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

"Slide Valve Gears," by Hugo Bilgram, published by Claxton & Co., Phila., describes the easiest method known for correctly proportioning slide valves, link-motions and cut-off gears; Price, $1.00.

New York, January 12, 1882.—I beg to request my correspondents to address me at my post office box, 3,306, New York City, and not at the office of "The Mechanical Engineer," in which none of my writings will in future appear, and with which I shall henceforth have no connection whatever. Joshua Rose, M. E.

"Useful Information for Steam Users." A 100-page *Illustrated Pamphlet*. Contains interesting data on the care and management of Steam Boilers, and rules for engineers and firemen. Engineers everywhere should have this work. Sent for 25 cents in P. O. Stamps. The J. N. Mills Publishing Co., 165 Broadway, N. Y.

The Universal Calculator—A novel labor-saving machine for solving questions in arithmetic and mensuration without mental labor. The most tedious problems solved in less than half a minute. Invaluable to engineers, mechanics, and business men. Sent free for $1. Send for circular. Address W. H. Wythe, Red Bank, N. J.

The J. N. Mills Publishing Co., 165 Broadway, N. Y., publishers of Steam Users' Business Directories for the New England States, 1880, New York and New Jersey, 1881, have in course of preparation their edition for PENNSYLVANIA and OHIO for 1882. Intending subscribers or advertisers for above work please address us early for circular and prospectus.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, neatly bound in cloth, ready to ship by express, for four dollars. Unbound, three dollars. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

Ealy's "Blue Book,"—Special classified list of Machinists, Machinery, Railway, Engine and Boiler Makers supplies, etc., with financial standing and paying qualities of all dealers and manufacturers. Much more convenient and reliable than any other work of the kind published. We also furnish full detailed written reports. Price $30 to July 1, 1882. The JOHN W. EALY COMPANY, 51 Chambers street, New York or 79 Dearborn street, Chicago, Ill.

THE SANITARY ENGINEER contains in the issue of Jan. 26, 1882—Illustrations with full descriptions of the remodeled Drainage of the White House; an illustrated article describing the Heating of Elevated Railroad Cars by steam supplied from the Locomotive; also, in other respects, it is an exceptionally interesting number. Single copies, 7 cents; can be obtained through newsdealers. Terms, $3 per year, in advance. Published every Thursday, at 140 William Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 Humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

The publishers of the Engineering and Mining Journal will issue January 4, 1882, and each Wednesday thereafter, COAL, a weekly journal, to be devoted exclusively to the interests of the coal trade, including: 1. The mining and preparation of coal for market. 2. Its transportation. 3. The marketing of coal. 4. The economical use of coal. COAL will be profusely illustrated, and the freight, labor and wages questions will be treated in a thorough and popular manner. The statistical information of COAL will be collected with great labor and care, and will give the current production of coal throughout the country. COAL will be conducted by gentlemen of ability and great experience in every department of the coal trade, and will have, at the outset, a large staff of reliable correspondents at the different coal centers of the country. Subscription price, $2 per year. Specimen copies on application. Address The Scientific Publishing Company, 27 Park Place, New York. P. O. Box 1833.

MANUFACTURES.

E. C. Howard is enlarging his foundry at Sandwich, Mass.

The Hendey Machine Co., Torrington, Conn., are enlarging their machine tool works.

Beloit, Wis., capitalists are considering the project of establishing a bell factory.

The Atlas Engine Works, of Indianapolis, are erecting a boiler shop 50x250 feet.

George H. Whitney, Nashua, N. H., is building an addition to his machine shop.

Car shops of the Central Pacific Railroad are under construction at West Oakland, Cal.

The Maine Central Road will probably erect extensive shops at Portland, Me., that city having offered special inducements.

Youngstown, Ohio, is negotiating for the establishment of mammoth locomotive works at that place. So says the *Railway Age*.

The Minneapolis, Minn., Harvester Works have filed a certificate of increase of stock amounting to $350,000, making the total stock $500,000.

The Chicago Locomotive Works will soon ask for bids for the construction of their buildings and machinery.

The Nashua, N. H., Iron and Steel Works have recently shipped an 8-ton steel shaft to San Francisco.

The Boston, Mass., Machine Company contemplate adding the construction of locomtives to their business.

There is talk of starting another foundry at Westfield, Mass., to be devoted entirely to job work.

A number of capitalists in Louisville, Ky., are moving for the establishment of locomotive works in that city.

The Pennsylvania Railroad Company has about decided to have ten locomotives built at the shops of the P. W. & B. Road at Wilmington.

The Cuyahoga Works, Cleveland, O., are now setting up a new compound engine of 700 horse power for an elevator in Chicago.

Fuller & Wilson, Worcesster, Mass., have built several 18" engine lathes for the Providence Steam Engine Co.

J. M. Veach & Co., of Adairsville, Ga., are building a new mill, and will put in a 14"x42" Atlas Corliss engine, and a pair of boilers to furnish power The entire outfit will be furnished by the Atlas Engine Works, of Indianapolis.

Every machine tool builder in Worcester is crowded with orders, yet somehow is ready to take a few more good ones whenever they are to be placed.

The Westinghouse Air Brake Company pays its employees, into whose houses small pox has crept, full wages, while requiring them to remain at home.

The Whitcomb Manufacturing Co., Worcester, Mass., have 35 men at work, principally in the building of iron planers. They have just advanced prices of planers fifteen per cent.

The contracts for the enlargement of the Indiana Cotton Mill at Cannelton, Ind., the first and largest in the State, have been let. The enlargement and additional machinery will cost $250,000.

F. H. Reed, Worcester, Mass., is making ten of his new 15" engine lathes a month, besides drills, hand-lathes, etc., and is satisfied he could sell twenty a month if the shop could turn them out at that rate.

W. C. Young & Co., Worcester, Mass., have just built five 12" swing speed lathes of a new design, one with and the others without back gear. The lathe is of a neat pattern and has a novel method of holding the spindle.

The Wright Steam Engine Governor, illustrated in our issue of December 3, 1881, is now made by the Wright Machine Co., Worcester, Mass., who will soon place upon the market a rotary form of the governor.

Prentice Bros., Worcester, Mass., are making some very large drilling machines. The base plate of one we saw in their shop weighs half a ton. They are getting out a new drilling machine which will soon be placed before the public.

C. C. Webster has lately taken a shop in Worcester, Mass., near the Union depot. He is building the oscillating "Business Engine," and has just brought out a new pattern of blacksmiths' upright drill.

Boynton & Plummer, Worcester, Mass, have just made a lot of six 12" square crank planers, to run by hand or power. In one week recently, they had orders from one concern for 52 blacksmiths' upright drills.

Western chair manufacturers, who complain of the competition of convict made cheap chairs, are moving in the matter of securing such legislation as will relieve them from what they consider to be a great injustice.

P. Blaisdell & Co., Worcester, Mass., have eighty men regularly at work making machine tools. Their new 60-foot addition contains seven planers now running, and will have five more in a week or two.

L. Coes & Co., Worcester, Mass., made 18,000 screw wrenches in December. Prices of their goods have advanced twice within four months, and orders are crowding them beyond precedent for this season of the year.

The Otis Iron and Steel Co., Cleveland, O., are rolling Siemens-Martin steel boiler plates 100 inches long. The Standard Oil Co., have each of their boilers made from two of these plates with seams at the sides. These boilers are six feet in diameter.

David W. Pond, Worcester, Mass., has 275 men at work building machine tools, exclusive of the force in the foundry. The new 80x80-foot addition for a planing room is being fitted up with tools, which will give an increased capacity for turning out work. He has just brought out a new style of long planer.

The Folger Manufacturing Company, at Springfield, Ohio, commenced about two years ago, under the name of A. E. Folger & Co. Their specialty was the Buckeye Upright Hand Drill Press. In the past year their business has nearly doubled, and this year they start out under the new name with very encouraging prospects. They also manufacture light power presses with hand and automatic feed. Their works are increased materially in capacity, and they are filling orders as rapidly as possible.—*Industrial World.*

A. M. Powell & Co., Worcester Mass., have thirty men at work making machine tools. They are building lathes of 18", 20", 22" and 26" swing, and have drawings ready for a 36" lathe. They also have drawings ready for 22", 26" and 32" square planers of a new design. Patterns are making for the 22" and 32" sizes. In their latest style of lathe, the tail stock setting-over screw is graduated, so that turning it from one mark to the next will set over the tail .001 of an inch. It also has the same graduation on the cross screw for the compound block, and on the rest screw. We noticed, while passing through their shop, a spindle for a 26" lathe, with front bearing 4⅛"x6½". The back bearing was 3¼"x5". This firm will, in the Spring, build an addition to the shop for a planing room.

Wm. Allen & Sons, Worcester, Mass., have just completed a 30x40-foot addition to their machine shop, and will soon erect a 100x50-foot addition to their boiler shop. Among the boilers (all steel) they have just built and shipped are the following: Two of 100 horse power each to a Baton Rouge, La., cotton mill; two of 80 horse power each to E. & A. H. Batcheler, No. Brookfield, Mass.; one locomotive boiler to Worcester & Nashua R. R.; two of 80 horse power each to Renfrew Manufacturing Co., No. Adams, Mass.; one 40 horse power marine boiler to Providence. They are building one boiler for Quaker Mills, Ravenna, Ohio. They have just shipped one 10x4-foot feed water heater and purifier to L. S. Iron Co., Ishpeming, Mich., and one extra large heater to State Lunatic Asylum, Worcester.

Machinists' and Engineers' Supplies.

NEW YORK, Feb. 2, 1882.

The supply market continues active. Larger orders are coming in, and more of them. There is an extensive inquiry, and the impression seems to prevail that, with the opening of Spring, supplies will be very scarce. The manufacturers are all busily engaged in filling back orders. The market is entirely cleaned of second-hand tools, and persons in search of new lathes and planers generally arrive at the store to find that the last one of the kind desired was sold the day previous. It is still probable that prices will advance.

Iron and Metal Review.

The Pig Iron market remains firm in tone, with a moderate inquiry. Consumers are buying only small lots for immediate use, and prices remain unchanged. We quote Foundry No. 1 at $26.50 to $27; Foundry No. 2 X, $25; Gray Forge, $23.50 to $24

The market for Foreign Iron remains in the same quiet state as when last reported with a light inquiry. This condition of affairs is agravated by the high prices demanded by holders as well as the fact that there is only a small stock on hand.

We quote Gartsherrie at $26.50 to $27; Coltness, $28.50; Glengarnock, $25.50 to $26; Carnbroe, $25; Eglinton, $24.50 to $25.50; Summerlee, $27.50.

Prime Wrought Iron Scrap in demand at $31.50 to $32. Merchants' Bar Iron continues active with prices unchanged.

Steel and Iron rails quiet with no change in prices. Old rails firm but quiet at $31 to $31.50 for Tee's, and $32 for Double heads.

Copper is dull this week and prices lower. We quote Lake Superior at 20c. Banca Tin, 26c. to 26⅛c.; Straits and Malacca, 24⅝c. to 24¾; Australian, and Billiton, 24⅛c.; Spelter, Western, 5¾c. to 6c. Refined, 8c. to 8¾c. Silesian, 5¾c. to 5⅞c. Lead, 5c. to 5¼c. Antimony 14½c. to 15c.

WANTED

"Situation and Help" Advertisements, 30 cents a line, each insertion. About seven words make a line. Should be received Thursday morning.

A Mechanical Draughtsman desires re-engagement. Address "H," P. O., D. 38, New Haven, Conn.

Brass Finisher—To good active lathe hand steady employment. Good wages. Healthy, pleasant and cheap city to live in. Waterous Engine Works Co., Brantford, Canada.

Wanted.—Foreman of iron foundry desires a situation; has had experience, and can bring good recommendations. Valve work a specialty. Address Box 4, AMERICAN MACHINIST.

Wanted—Foreman for Machine Shop; must have experience and capacity to handle one hundred men, accustomed to Engine work and shop regime. References required. Address, A. W. H., Middletown, O.

Machinist Wanted—A rare chance, if applied for soon, for a first-class, thorough going, practical machinist, with from $1,500 to $2,000 capital to invest. Address, S. E. W., Box 1, AMERICAN MACHINIST Office.

Mechanical Engineer and Draughtsman of long experience wishes suitable employment. Have long experience in designing of Machinery—new and special—looms, &c. Correspondence invited. Address, C. R., Room 16, First National Bank Building, Worcester, Mass.

A machinist desires an engagement. Has large experience in constructing, building and erecting steam engines, hydraulic and other machinery and tools. Has 19 years experience in this country and Europe. Can give best of reference, and no objection to the country. Permanent situation desired. Address Box 13, AMERICAN MACHINIST office.

Wanted.—To purchase a good Engineer's Transit must be cheap for cash. R. S., 206 East 50th St.

Wanted—A second-hand steam engine; vertical preferred, with about 2½"x4" cylinder. Address A. Baker, Westfield, Pa.

MECHANICAL DRAWINGS,

Designs, Tracings and Patent Office Work executed with despatch. **WOOD & RICHMOND,** Mechanical Engineers and Draughtsmen, 176 Broadway, New York.

Lodge, Barker & Co.
S. E. Cor. Pearl and Plum Sts.
CINCINNATI, O.
Manufacturers of
18" ENGINE LATHES
AND SMALL TURRET LATHES.

JUST PUBLISHED. PRICE, $1.40. MAIL FREE.
A TREATISE ON
IRON FOUNDING,
By CLAUDE WYLIE,
Practical Iron Moulder.
Written for practical men in both large and small foundries.
E. & F. N. SPON, 446 Broome Street, N. Y.

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MACHINERY FOR REDUCING AND POINTING **WIRE**
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COOKE & CO., (Formerly Cooke & Beggs),
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And Dealers in
MACHINERY AND SUPPLIES
Of every description,
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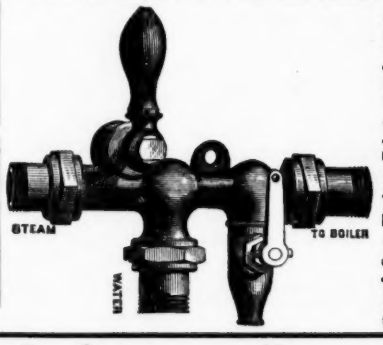

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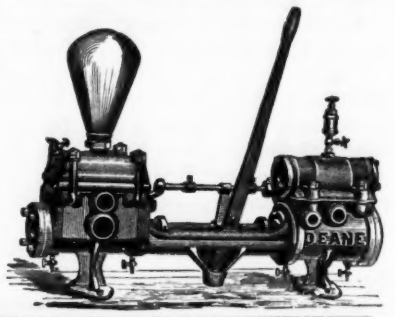

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Being a complete school for the Apprentice as well as the Advanced Machinist, showing how to make and use every tool in every branch of the business; with a treatise on Screws and Gear-Cutting. By WALTER FITZGERALD.
1 Vol., 18mo, Cloth. 75 cents. Published and for sale by **JOHN WILEY & SONS,**
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Is the Standard of Excellence
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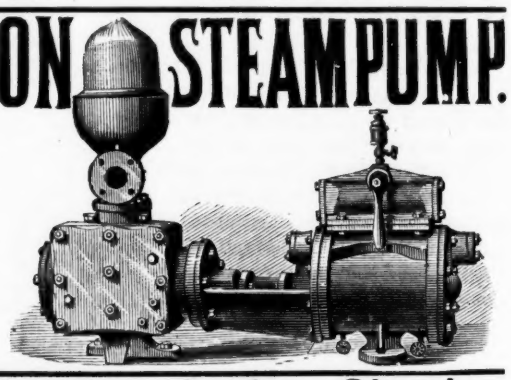

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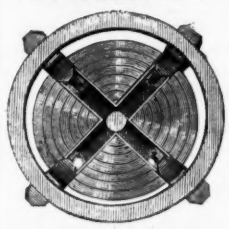

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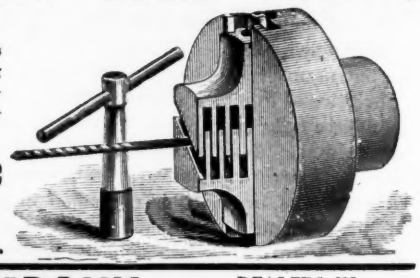

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Manufacturers of
The ALLEN PATENT HIGH-SPEED ENGINE.

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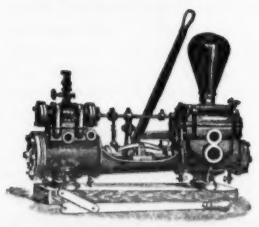

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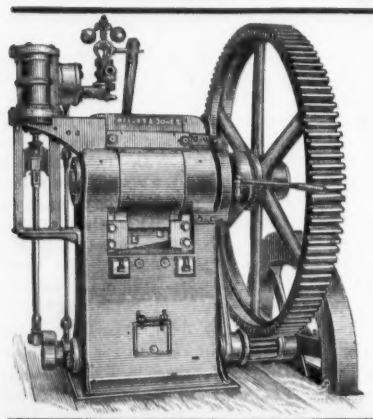

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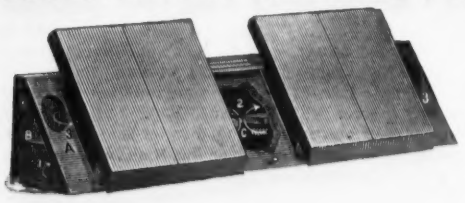

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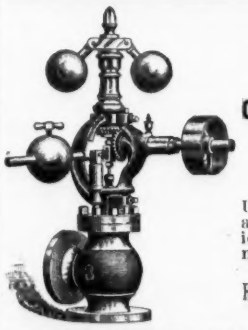

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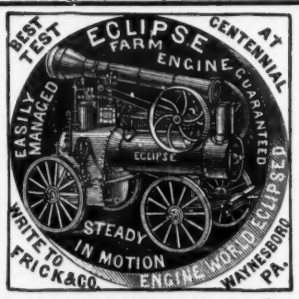

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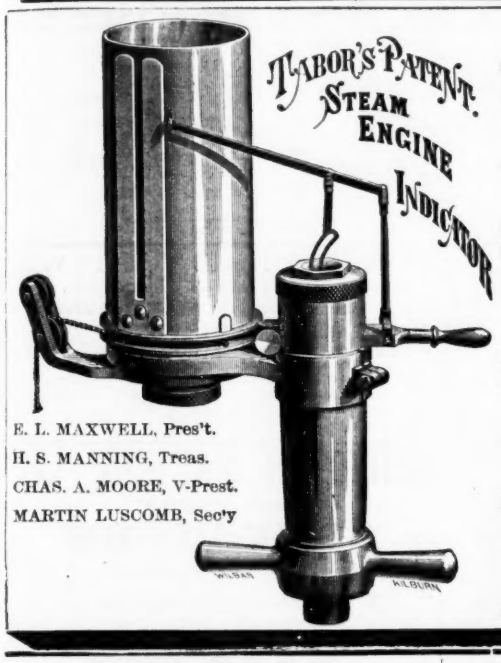

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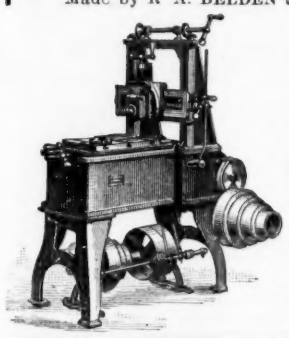

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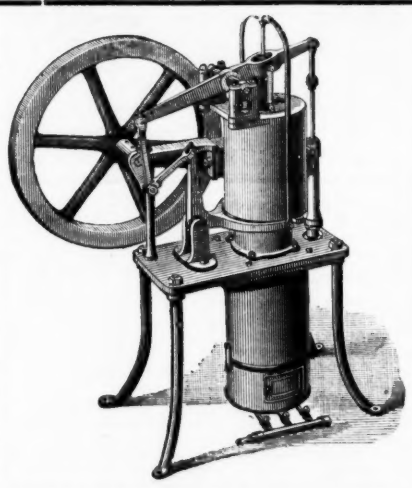

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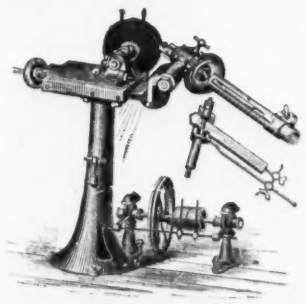

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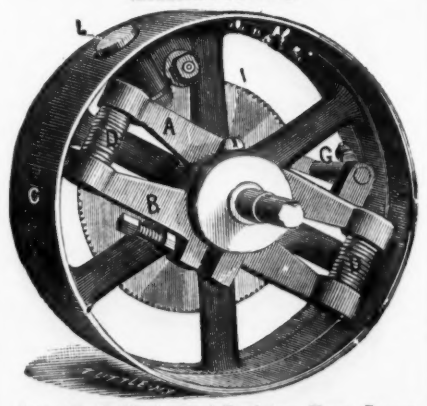

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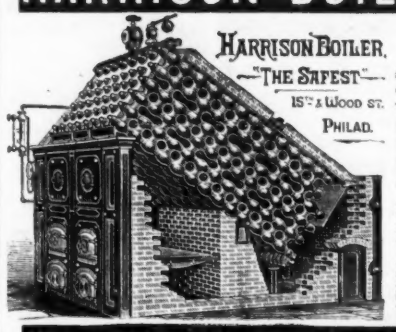

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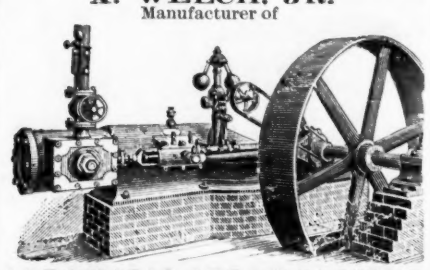

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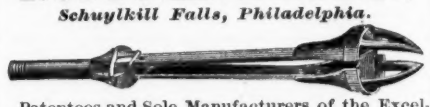

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" 10	1 1-2	"	1.10
" 11	1 3-4	"	1.25
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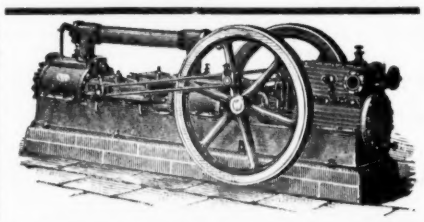

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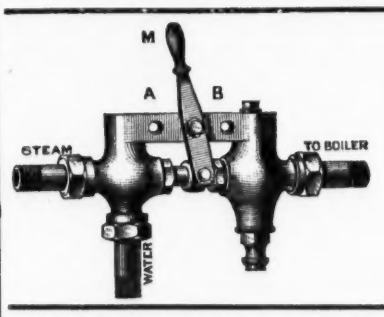

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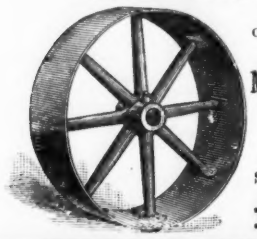

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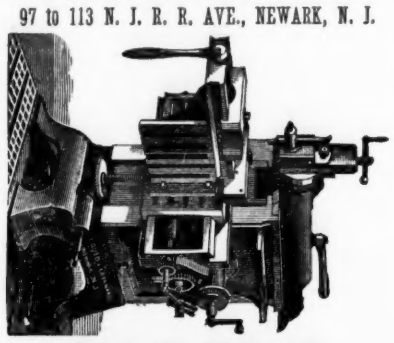

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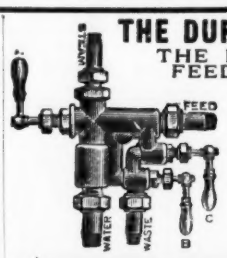

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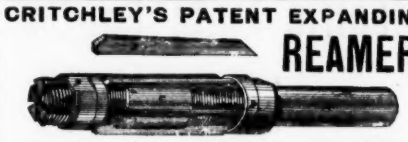

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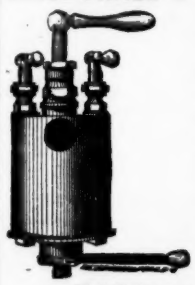

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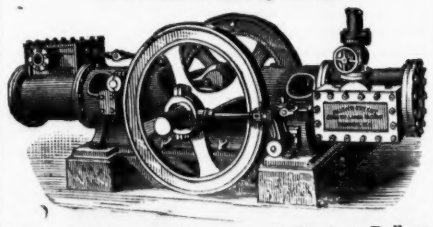

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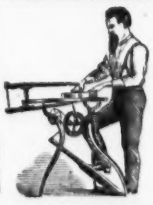

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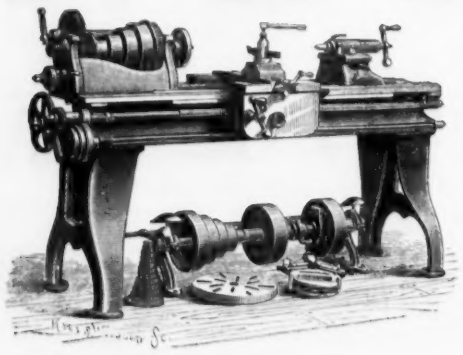

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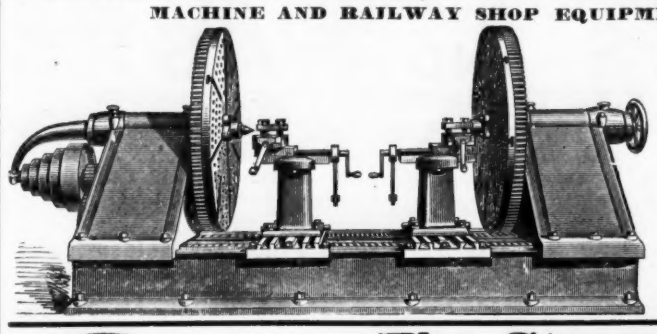

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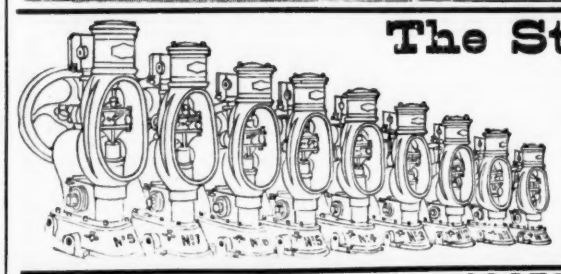

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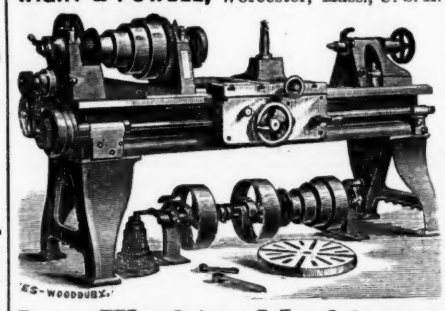

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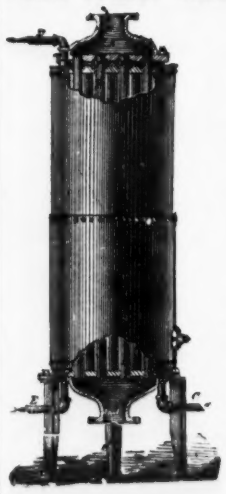

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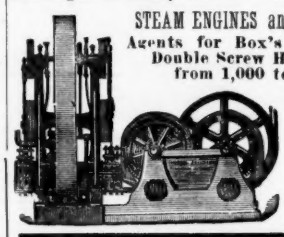

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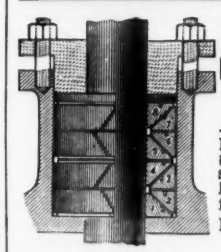

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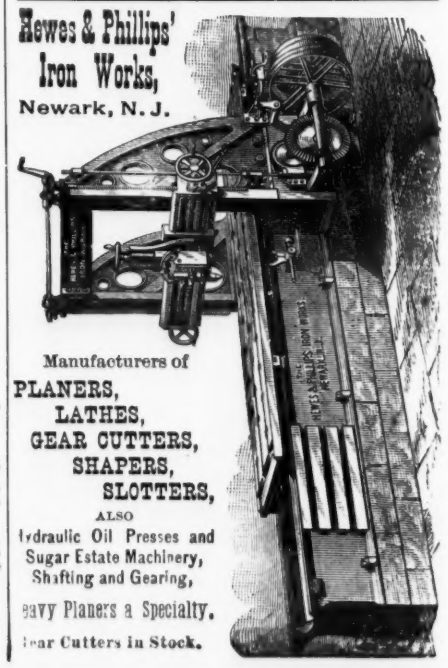

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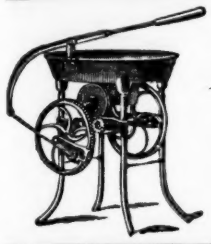

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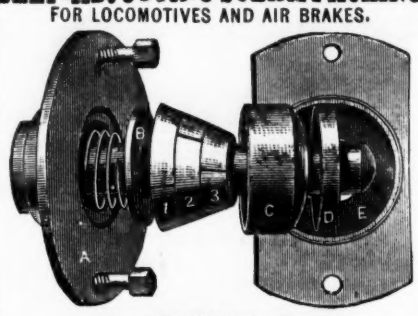

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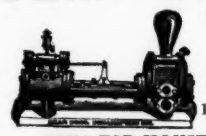

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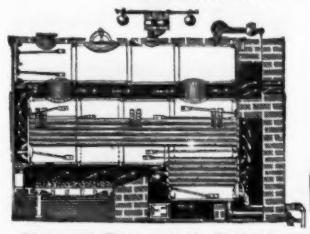

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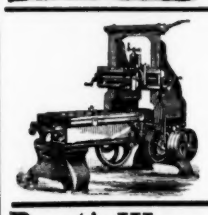

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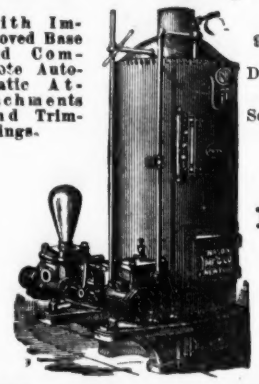

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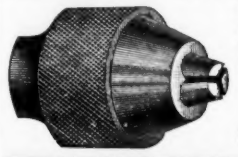

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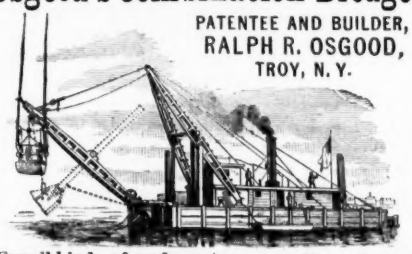

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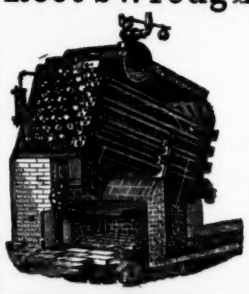

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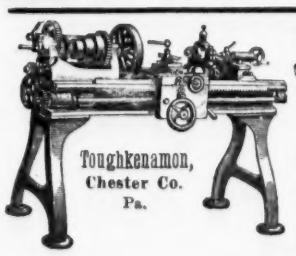

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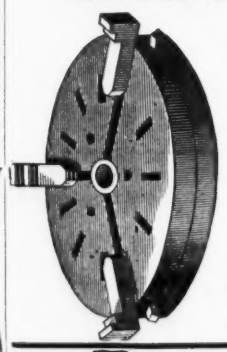

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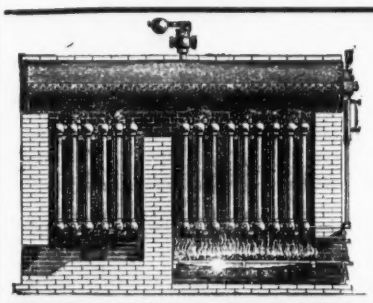

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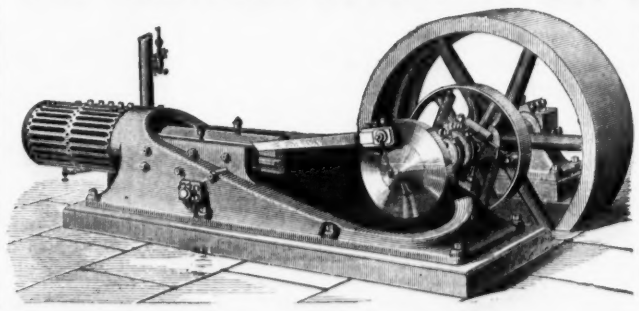

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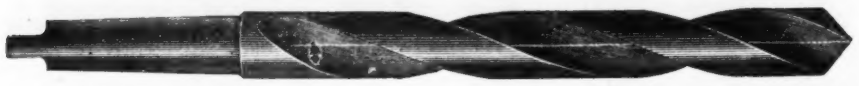

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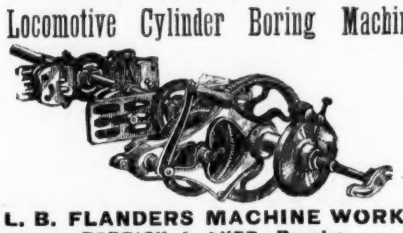

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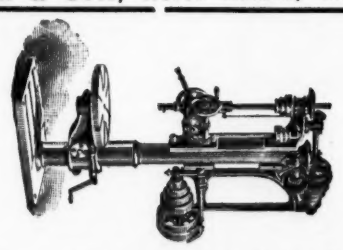

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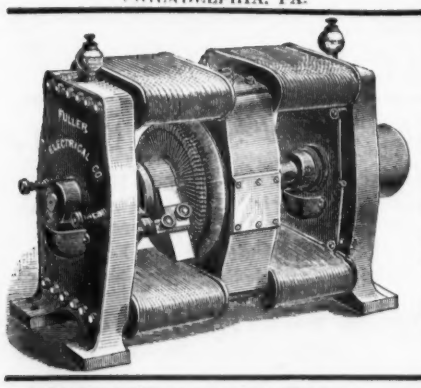

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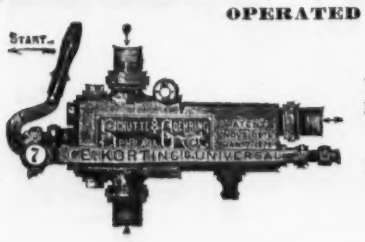

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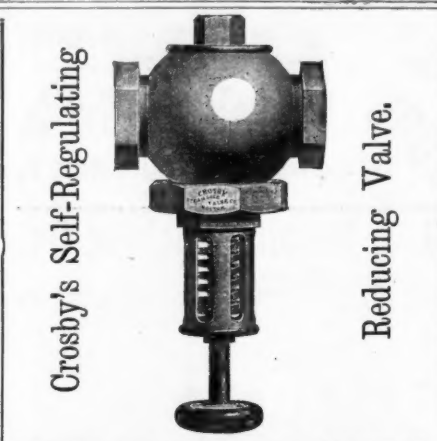

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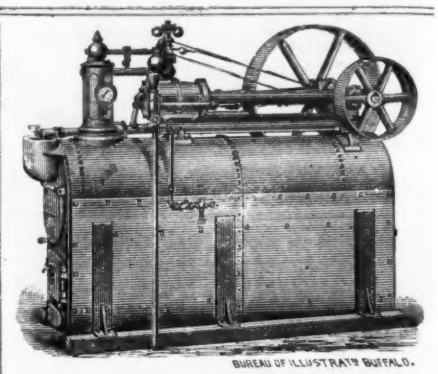

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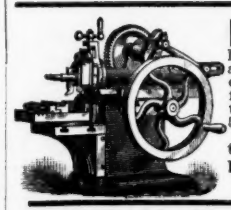

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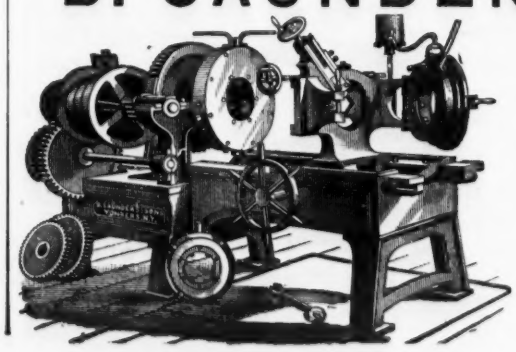

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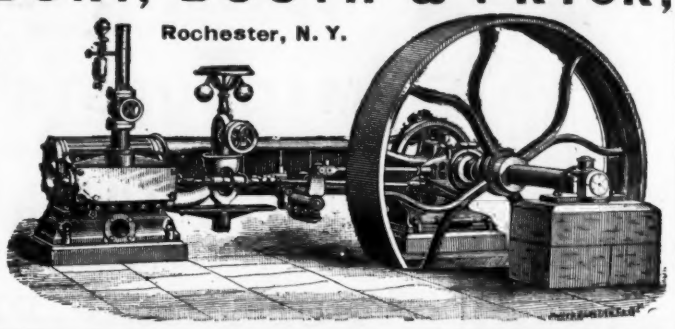

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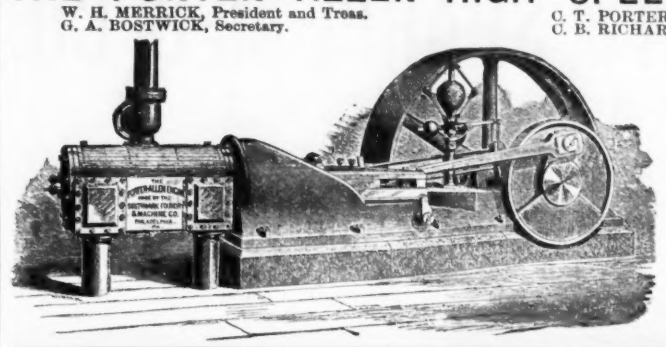

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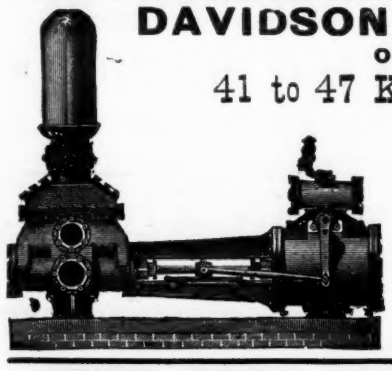

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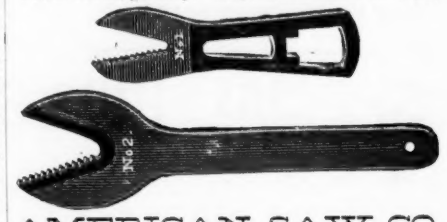

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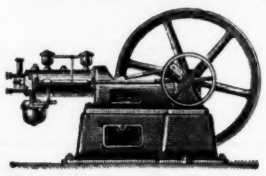
No explosions; No Fires nor Cinders; No Gauges; No Pumps; No Engineer or other attendant while running.



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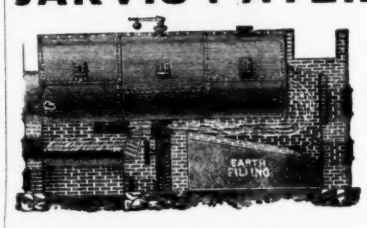

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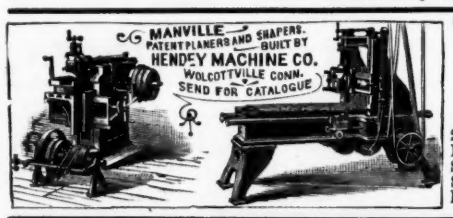

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The following New and Improved Machinists Tools are part of what we have for early delivery:

2 30 in. x 30 in. x 8 ft. Planers. New. March.
2 30 in. swing, 15 ft. bed. Engine Lathes. February.
1 22 in. swing, 13½ ft. Bed Engine Lathes. "
3 18 in. " 10 ft. " " "
3 18 in. " 8 ft. " " "
2 30 in. " Upright Back Geared Drills. "

The following in store:

1 22 in. swing, 12 ft, Bed Engine Lathe. New.
1 19 in. " 6 ft, " " 2d-hand.
2 19 in. " 10 ft. " " New.
2 19 in. " 8 ft. " " "
3 18 in. " 8 ft. " " "
2 15 in. " 5 ft. " " "
1 15 in. " 8 ft. " " "
1 17 in. " 6 ft. " " 2d-hand.
1 17 in. " 7½ ft. " " "
1 15 in. " 5 ft. " " "
1 12 in. " 4 ft. " " "
1 21 in. " 10 ft. Bed Turret Head Lathe.
1 15 in. " 9 ft. Hand Lathe. New.
3 12 in. " 6 ft. Bed Hand Lathe. New.
1 10 in. " 4½ ft. " " "
1 38 in. swing Pulley Lathe, new.
1 Round Arbor Fox Lathe.
1 15 in. Hendey Shaper. New.
2 48 in. Swing Radial Drills. New.
1 22 in. Upright Drill. B. G. & Self Feed. New.
2 20 in. Upright Drills. Back Gear. New.
1 21 in. Upright Drill. Nearly New.
1 24 in. Harris Upright Drill. Second-hand.
2 Wall Drills, heavy. Second-hand. 60 and 72 in
1 3 Spindle Drill. New.
2 Milling Machines, Lincoln pattern. Second-hand
2 Manhattan Arms Co. Millers. Second-hand.
1 Sellers Milling Machine. 2d-hand.
1 Face Milling Machine. Second-hand.
1 Pond's Double Milling Machine. 2d-hand.
1 No. 2 Screw Machine. New.
1 Screw Head Slotter. Second-hand.
3 Second-hand Profiling Machines.
1 Vertical Centering Machine. Nearly new.
3 4½ in. Horizontal Centering Machines. New.
3 Emery Grinders. 2d-hand.
1 Sellers' Tool Grinder. "
1 Pipe Cutting Machine. Second Hand. 2 in.
1 Bolt Cutter, 1½ in. New. With Taps and Dies
1 Bolt Pointing Machine. Second-hand.
1 Double Nut Tapper. New.
3 Pulley Forcing Machines. Second-hand.
1 Horizontal Boring Bar, 12¾ in. diam. " "
1 " " Machine, Small. 2d-hand.
1 " " " 4 spindle "
1 Betts, No. 2, Power Punch. New.
4 Double-Acting Presses, No. 3, nearly new.
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100 Foot Presses, nearly new.
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2 Small " " Presses. "
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One " " 28 in. x 16 ft. Fifield. New.
One " " 28 in. x 12 ft. " "
One " " 27 in. x 17 ft. B'lyn S. E. Works.
One " " 24 in. x 12 ft. Fifield. New.
One " " 24 in. x 10 ft. " "
One " " 24 in. x 10 ft. New Haven.
One " " 20 in. x 14 ft. Fifield. New.
One " " 20 in. x 10 ft. Pond. A1.
One " " 20 in. x 12 ft. Ames. New.
One " " 20 in. x 10 ft. " "
One " " 20 in. x 8 ft. " New.
One " " 18 in. x 9 ft. White'b. Good order.
Three Engine Lathes 18 in. x 8 ft. Jones & Lamson New.
One Engine Lathe, 16 in. x 6-7-8 ft. Bridgeport Mch. Tool Works. New.
Six Engine Lathes, 16 in. x 6 ft.-7ft. x 8 ft. Ames. New.
One " " 15 in. x 8 ft. Pratt & Whitney.
One " " 15 in. x 6 ft. Flather's. New.
Three " " 14 in. x 6 ft. Star Tool Co. New.
One " " 14 in. x 6 ft. Hand. New.
One " " 13 in. x 6 ft. Ames. New.
One " " 13 ft. x 4½ ft.
One " " 12 in. x 6 ft. Lincoln.
Two " " 11 in. x 5 ft.
One Hand Lathe. 12 in. x 5 ft.. Hendey. New.
Two " " 7 in. x 2½ ft. NewSpencer.
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One " 20 in. x 16 x 4 ft.
One " 20 in. x 20 x 4 ft. Thayer & Houghton.
One " 24 in. x 7 ft. New Haven. Good order.
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One 15 inch Stroke Shaper. Gould & Eberhardt. New.
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20 "	"	10	"	"	"	24 in. x 24 in. x 6 ft.	Hendey.
20 "	"	12	"	"	Ames.	24 in. x 24 in. x 6 ft.	Whitcomb.
21 "	"	10	"	"	Blaisdell.	26 in. x 24 in. x 6 ft.	Gleason
20 "	"	14	"	"	Powell.	26 in. x 24 in. x 7 ft.	"
24 "	"	12	"	"	Fifield.	24 in. x 24 in. x 8 ft.	Ames.
24 "	"	16	"	"	Blaisdell.	26 in. x 26 in. x 8 ft.	Pond.
26 "	"	16	"	"	Niles.	27 in. x 27 in. x 8 ft.	Whitcomb.
30 "	"	23	"	"	Ames.	28 in. x 28 in. x 6 ft.	Gleason.
32 "	"	26	"	"	Gleason.	28 in. x 28 in. x 8 ft.	"
36 "	"	16	"	"	Fitchburg.	30 in. x 30 in. x 8 ft.	Whitcomb.
36 "	"	20	"	"	"	30 in. x 30 in. x 8 ft.	Fitchburg.
40 "	"	16	"	"	Gleason.	36 in. x 36 in. x 12 ft.	Gleason.
50 "	"	20	"	"	Fitchburg.	42 in. x 42 in. x 16 ft.	"

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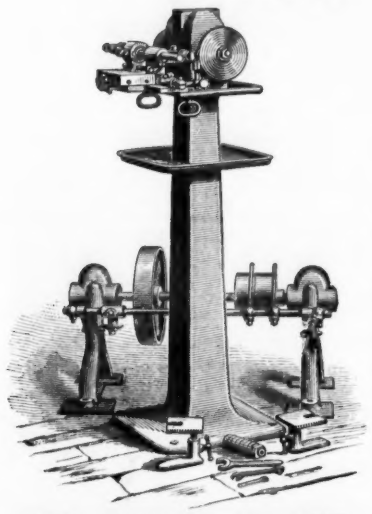

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With Cutter Sharpening Attachment.

This machine is the same as one we build, with Cutter Sharpening Attachment in addition. This attachment is for use on straight, spiral or cotter mills, and angular cutters. The straight or spiral mills are held upon a sleeve and moved past the wheel, the tooth being guided by a rest set to give the proper clearance. The bevel cutters are held upon a piece adjustable to any angle, being guided by tooth rest as on the straight or spiral mills. Cutters up to 4 inches long and 5 inches in diameter can be ground. The attachment can be instantly attached or detached Wrenches accompany the apparatus. Weight of machine, prepared for shipment, 300 lbs.

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SPECIAL PULLEY MACHINERY.

36 in., 50 in. and 60 in.

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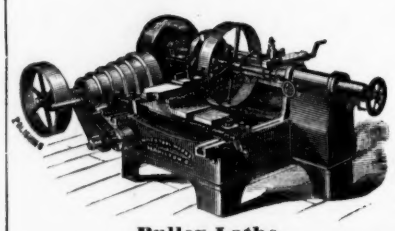
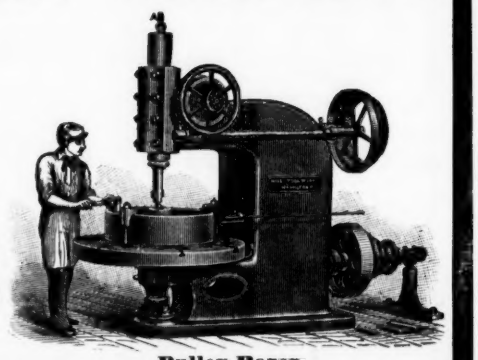


Pulley Lathe.



Pulley Borer.

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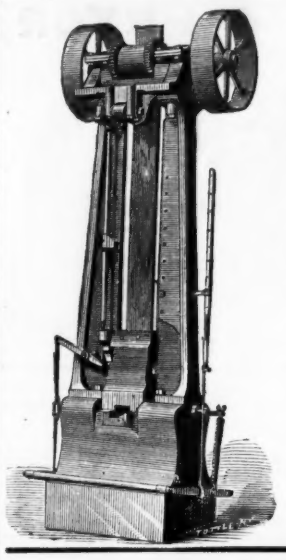

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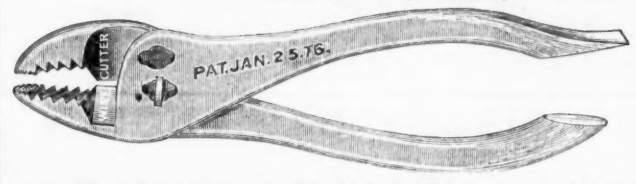

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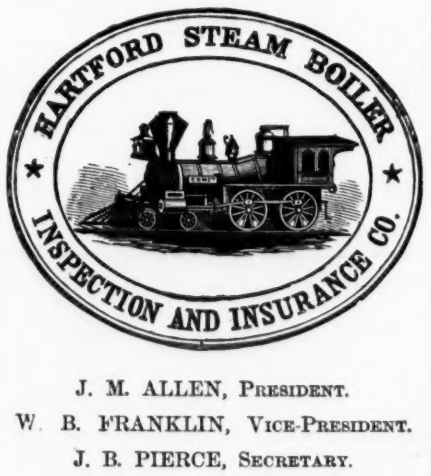

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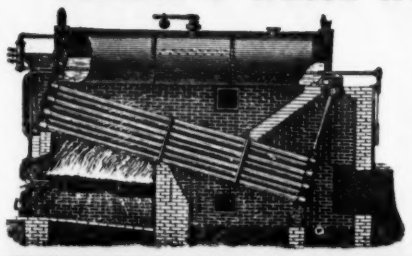

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